

# ELECTRICAL CONSTRUCTION AND MAINTENANCE

**MARCH • 1949**

*Featuring*

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A M C G R A W - H I L L P U B L I C A T I O N



THE FLUORESCENT FIXTURE  
YOU'RE LOOKING FOR

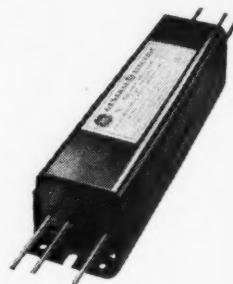
wears  
this tag

EQUIPPED WITH A



FLUORESCENT

Ballast



Keep an eye out for this tag when you're in the market for fluorescents. It means the fixture is equipped with a General Electric ballast—the industry's finest. It is *your* assurance of rated lamp life and maximum light output, of quiet and trouble-free operation.

All G-E ballasts are designed, built and tested for permanent lamp-matched characteristics. They get the most out of standard fluorescent lamps—give you the quality and economy you are looking for in fluorescent lighting. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

FLUORESCENT LAMPS do not draw current directly from the lighting circuit as do incandescent lamps. Instead, they are operated by a transformer or ballast—especially and carefully designed for the purpose. With fluorescent lighting, therefore, the amount of light you get from the lamps, the life of the lamp, and to some extent the life and efficiency of the fixture itself, depend to a large measure upon the characteristics of the ballast. Good ballasts mean better, more economical lighting.

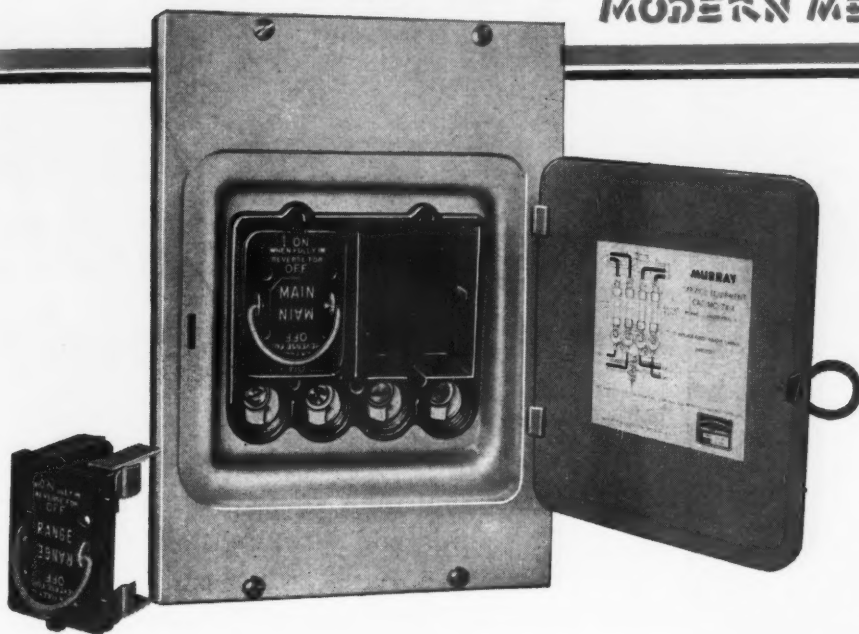
GENERAL  ELECTRIC

412-09



# Murray

-FAMOUS FOR  
MODERN METHODS



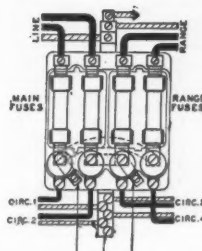
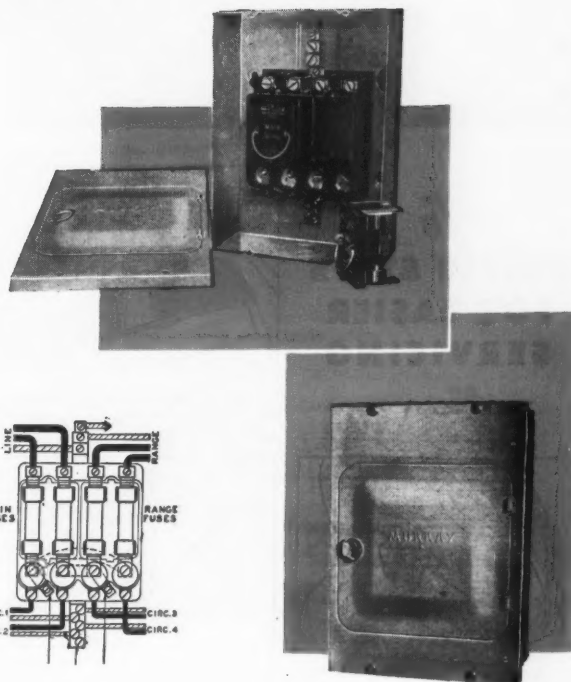
**T**HIS modern, good-looking switch is unmatched as a focal point for electrical distribution in homes. The block of this Murray Range Switch (No. 74-4) is one-piece Bakelite of high dielectric strength. The main and range switches are fuse-puller type — connections are solderless lugs. There are four lighting circuits and an extra solderless lug tap that can be used for a hot-water circuit.

Unit construction saves installation time; wiring is easy and hand room ample.

The cabinet is attractively constructed, requires little wall space, and installation in kitchens or utility rooms is not objectionable. For flush-type ask your jobber for No. 74-4F. Complete data in Bulletin No. 501. We suggest you send for it today.

# Murray

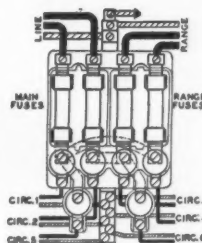
**MAIN AND RANGE  
SERVICE EQUIPMENT  
WITH BRANCH CIRCUITS**



**CAT. No. 74-4**

**MAIN**—80 Amp., 125-250 Volts, 3 P. 2 Cart. Fuses. Neutral Solid.

**BRANCH CONNECTIONS**—Range Circuit: 2 Cart. Fuses. Lighting Circuit: 4 Plug Fuses.



**CAT. No. 74-8**

**Has 6 Plug Fuse Lighting Circuits.**

Also supplied with Range Circuit independent of main service and lighting circuits (parallel connection), 100 amp. main solderless lugs, Cat. No. 77-4.

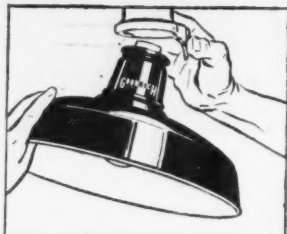
# APPLETON DISKONECT REFLECTORS

*the most practical*  
**DETACHABLE  
REFLECTORS  
ever made!**

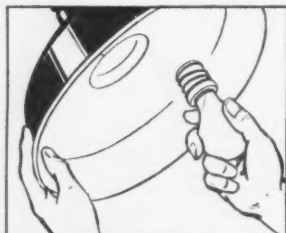


Pat. No. 1,993,385

## 5 SIMPLE STEPS FOR EASIER SERVICING



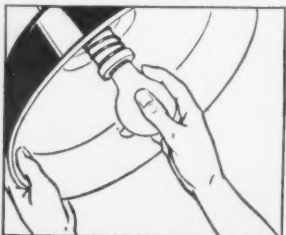
Release spring-set lever. Reflector and lamp are detached instantly, as a unit.



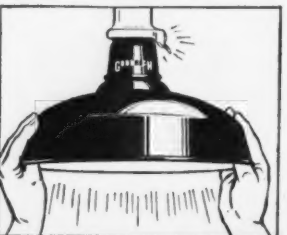
Lamp and socket are removed together. Slight upward pressure and a quarter turn remove them from reflector.



Reflector may be immersed in water for thorough cleaning to restore original reflecting surfaces.



Socket and lamp are returned to reflector and securely locked with merely a simple twist of the wrist.



Pressing reflector into hood, locks reflector in place, lights lamp, again delivers full illuminating efficiency.

Here's Appleton's answer to the ever-present problem of installing and servicing light reflectors quickly and easily. The Diskonect Reflector is attached or detached from the hood instantly by means of a snap lock—without twisting, tugging, forcing or the use of tools. The heavy drawn-steel hood is fitted with a spring-set lever which locks or unlocks the porcelain enameled reflector.

Even when the Diskonect Reflector remains in place for extended periods, detachment remains quick and easy. Corrosion and "freezing" together of component parts are prevented by metal-to-glass connection—heavy, rustless cadmium plate to porcelain enamel.

Diskonect Reflectors are finished in permanent porcelain enamel and offered in a wide variety of styles. Complete "come-apart" construction permits cleansing of all parts separately a time-saving feature that enables you to maintain a higher standard of lighting efficiency.

SOLD THROUGH ELECTRICAL WHOLESALE

**APPLETON ELECTRIC COMPANY**  
1704 WELLINGTON AVENUE • CHICAGO 13, ILLINOIS

Branch Offices: NEW YORK, 50 Church St. • DETROIT, 3049 E. Grand Blvd. • CLEVELAND, 1836 Euclid Avenue • SAN FRANCISCO, 655 Minna St. • ST. LOUIS, 420 Frisco Bldg. • LOS ANGELES, 100 N. Santa Fe Avenue • ATLANTA, 724 Boulevard N.E. • BIRMINGHAM, 429 Brown Marx Bldg. • MINNEAPOLIS, 305 Fifth St. S. • PITTSBURGH, 414 Bessemer Bldg. • BALTIMORE, 100 East Pleasant St. • BOSTON, 10 High Street • DENVER, 1509 Seventeenth Street • PHILADELPHIA, 1017 Cherry Street

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### USE THIS CONVENIENT BUYING GUIDE

A fully detailed and graphically illustrated Appleton Catalog will be mailed to you immediately upon request. Be sure to have one and use it for faster, easier—completely dependable purchasing of all lighting and electrical equipment.



# APPLETON

CONDUIT FITTINGS • LIGHTING EQUIPMENT • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

# ELECTRICAL CONSTRUCTION AND MAINTENANCE

With which is consolidated *Electrical Contracting*,  
*The Electragist* and *Electrical Record* ... Established 1901

A practical technical and management journal for electrical contractors, industrial electricians, inspectors, engineers and motor shops,  
covering engineering installations, repairing, maintenance and management, in the field of electrical construction and maintenance.

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*Top speed in the tight spots*  
with **TOLEDO**  
**RATCHET THREADERS**



Toledo No. 11 Ratchet Threader,  $\frac{1}{2}$ " to  $1\frac{1}{4}$ " pipe.

**IDEAL ALL-AROUND TOOLS  
TO SAVE TIME..CUT COSTS!**

When the job calls for close corner work—it's a "natural" for Toledo Small Ratchet Threaders! These time-proven tools will save time for *you*—producing clean-cut, leak-proof threads . . . quickly and easily . . . in the most difficult corner job.

Because these tools are so compact . . . light in weight . . . and easy handling . . . thousands of better mechanics today prefer Toledo Ratchet Threaders for all-around use!

For any pipe tool requirement, you can't beat genuine TOLEDO equipment—hand tools or power. These are the tools that get the work done *faster, better and at lower cost!* The Toledo Pipe Threading Machine Co., Toledo, Ohio. New York Office, No. 2 Rector Street Building.



Toledo No. 00 Ratchet Threader,  $\frac{1}{8}$ " to  $\frac{1}{4}$ " pipe.



Toledo No. 12 Ratchet Threader,  $\frac{1}{2}$ " to 2" pipe.

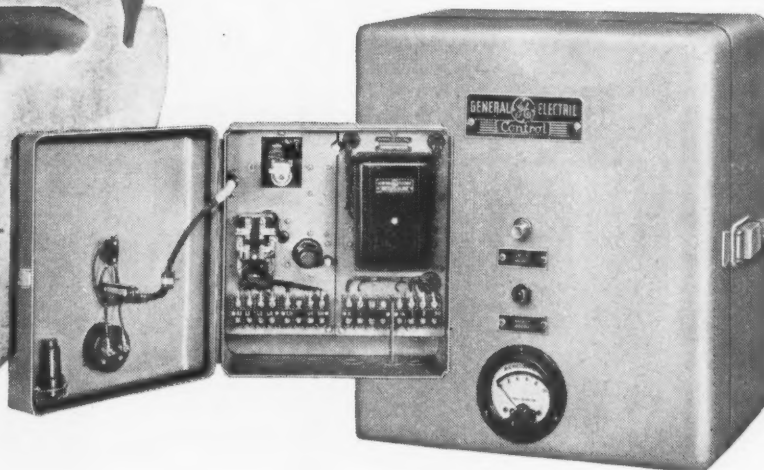
RELY ON THE LEADER

**TOLEDO**  
FOR PRECISION PIPE TOOLS

ELECTRICAL CONSTRUCTION AND MAINTENANCE. Published monthly. Price 35 cents a copy. Vol. 48, No. 3. Allow at least ten days for change of address. RETURN POSTAGE GUARANTEED. Publication office, 99-129 N. Broadway, Albany 1, N. Y. All communications about subscriptions should be addressed to J. E. Blackburn, Jr., Vice-President (for Circulation Operations), Electrical Construction and Maintenance. Subscription rates—U. S. and possessions, \$3.00 a year, \$4.00 for two years, \$5.00 for three years. Canada \$4.00 a year, \$6.00 for two years, \$8.00 for three years. Pan American countries \$6.00 for one year, \$10.00 for two years, \$12.00 for three years. All other countries \$15.00 a year, \$30.00 for three years. Please indicate position and company connection on all subscription orders. Entered as second class matter August 29, 1936, at Post Office, Albany, N. Y., under the act of March 3, 1879. Printed in U. S. Copyright 1949 by McGraw-Hill Publishing Company, Inc. Cable address: "McGraw-Hill, New York." Member A. B. P. Member A. B. C.

**BRAIN...**

**for commercial OIL BURNERS**



**New G-E control  
provides "double-check"  
protection against:**

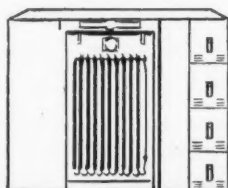
**PILOT FAILURE      FLAME FAILURE  
POWER FAILURE      CARBONIZING  
COLD-OIL STARTING**

**COMPLETE OIL-BURNER PROTECTION . . .** that's what you get when you specify General Electric's new photoelectric combustion control. It's a complete, co-ordinated system including master control unit, photo-tube holder and electrode holder. Assures positive protection against combustion failure by immediate fuel cut-off. All components of the system are easily removable for inspection and test without disturbing connections. Write for Bulletin GEA-4779: "Photoelectric Combustion Control for Commercial Oil Burners."

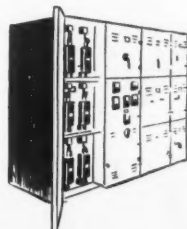
Development of this device is yet another proof that General Electric keeps abreast of commercial-building needs with complete electric equipment for all types of service: elevators, heating and ventilating, power distribution and conversion. Your nearest G-E sales office will have an application engineer help you plan your entire electrical system. **Apparatus Dept., General Electric Company, Schenectady 5, N. Y.**



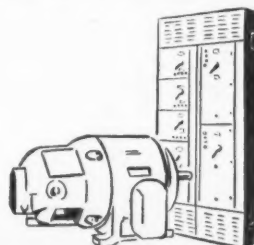
**EQUIPMENT FOR COMMERCIAL BUILDING**



**Power-distribution systems**



**Rectifiers for Power Conversion**



**Motors and Control**

**GENERAL  ELECTRIC**

For super-durability in small diameter

# Specify Flamenol Cable

**Unsurpassed thermoplastic insulation—made *only* by G.E.—provides an *extra* margin of safety on your low-voltage feeder circuits**

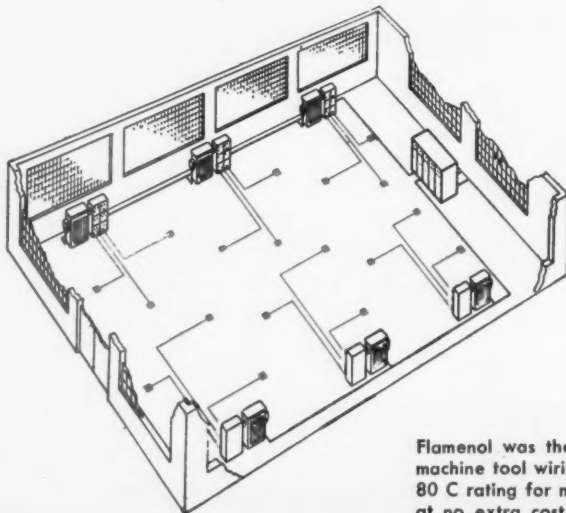
Plant conditions that menace most wiring seldom bother Flamenol®, General Electric's superior, synthetic-insulated cable. Here, in one cable especially developed to overcome the disadvantages of other types, are combined the important advantages of long life and easy workability.

**Inherent stability for long life.** It's the insulation that makes the big difference. Flamenol offers a single thermoplastic covering that is both insulation and finish. But there's a difference in thermoplastics. Flamenol insulating

compound—made only by G.E.—consists of polyvinyl chloride plus various plasticizers and stabilizers. Chemically inert, it possesses exceptional resistance to all those common enemies of cable life—moisture, aging, acids, alkalis, oils and greases. Moreover, its flame resistance minimizes fire hazards.

**Small diameter for fast wiring.** These long-life properties are packed into a small diameter that saves space and simplifies wiring in areas where space is at a premium. Its hard, smooth finish is free-stripping for easy splicing and terminating, and is easily pulled through ducts. Seven bright colors are available for quick circuit tracing.

**Rigid control for service reliability.** As proved by billions of feet now in service up to 13 years, Flamenol's quality is carefully guarded from start to finish by rigid manufacturing controls to assure greatest service reliability. In all types, sizes and degrees of flexibility to meet your needs, Flamenol is available right now from stock. For more information, check your local G-E representative, or write for Bulletin GEA-4352. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



Flamenol was the first 600-volt cable of its kind approved for 80 C operation in machine tool wiring. While this same cable has only a 60 C rating for raceways, the 80 C rating for machine use does mean you can count on an extra margin of safety at no extra cost when you use Flamenol for low voltage feeder circuits.



## STANDARDIZE AND SAVE

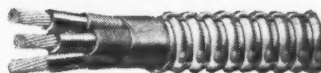
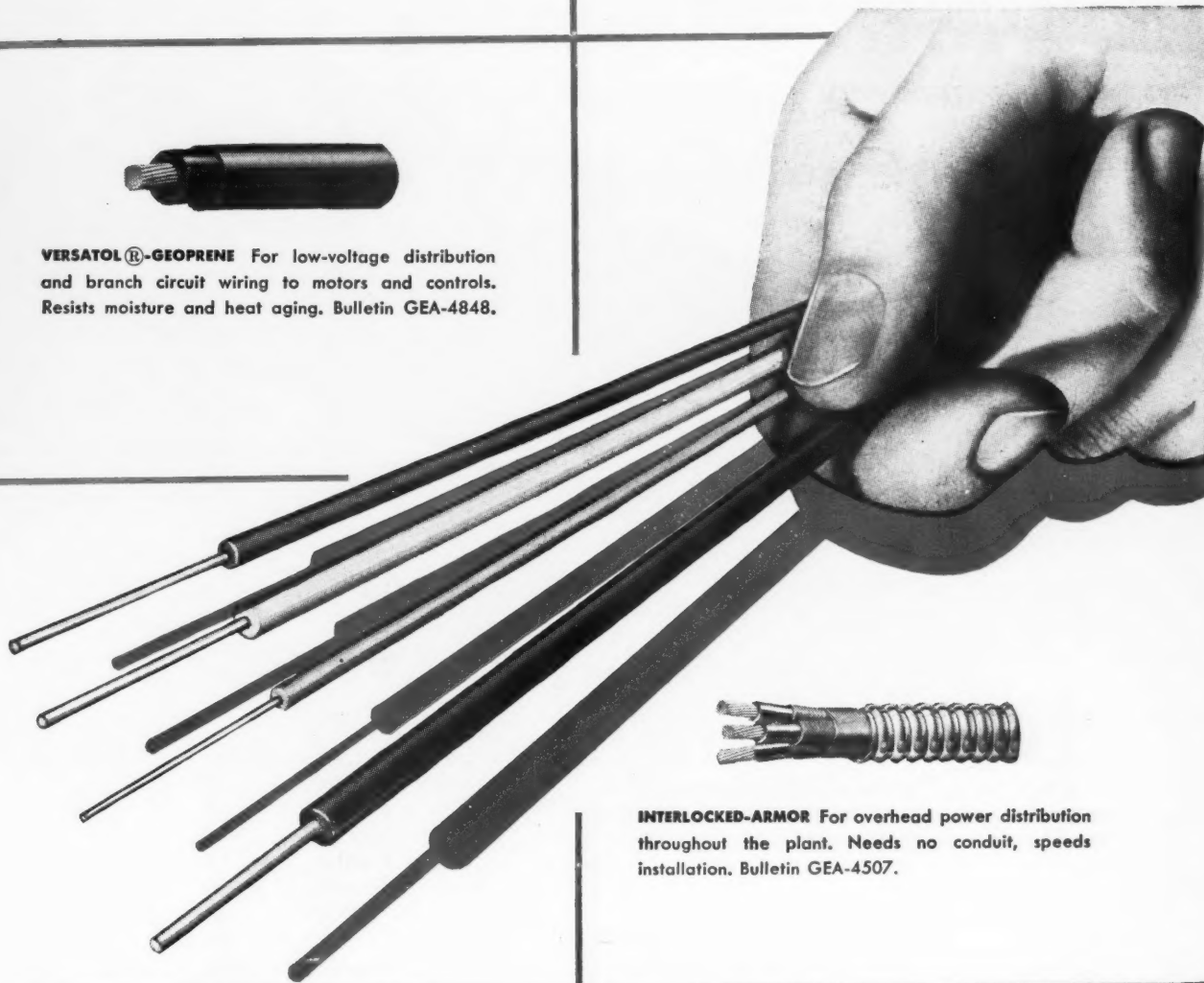
**FLAMENOL**—in all standard 600-volt constructions—is one of six modern cables mass produced and authorized for warehouse stock. Standard designs permit quicker delivery and a lower price than special types. Each offers advantages in its recommended applications.



**CORONOL®-GEOPRENE** For high-voltage power distribution. Has superior resistance to heat, corona, and aging. Bulletins GEA-1788, GEA-4848,



**VERSATOL®-GEOPRENE** For low-voltage distribution and branch circuit wiring to motors and controls. Resists moisture and heat aging. Bulletin GEA-4848.



**INTERLOCKED-ARMOR** For overhead power distribution throughout the plant. Needs no conduit, speeds installation. Bulletin GEA-4507.



**GEOPRENE PORTABLE CONTROL** For connection between control panels and portable push-button stations on large machines. Resists rough handling and severe flexing.



**VARNISHED-CAMBRIC LEADED** For high-voltage feeders, distribution in underground ducts. Ideal for heavy loads in wet locations. Bulletin GEA-2623.

# GENERAL ELECTRIC

502-96

# Smithcraft Troffers

## AMERICA'S FINEST RECESSED LIGHTING FIXTURES

"SMITHCRAFT MUST HAVE DONE PLENTY OF RESEARCH BEHIND THE CEILING LINE"

"WE INSTALL IT WITHOUT EXACT POSITIONING"

"THAT'S THE AMAZING ALIGNER HANGER"

"THE ALIGNER HANGER LETS US ADJUST AND LEVEL THE TROFFER EVEN AFTER INSTALLATION"

"IF WE'D WANTED GLASS OR LENS SHIELDING, SMITHCRAFT'S HINGED ENVELOPE FRAME WOULD HAVE HELD IT WITHOUT CLIPS . . . EASY TO HANDLE AND CLEAN"

"SMITHCRAFT USES ZINC-COATED BONDERIZED STEEL FOR THE HOUSING AND REFLECTORS TO RESIST CORROSION"

"THAT LOUVER IS REALLY RIGID—THERE'S NO SAG ANYWHERE"

"IF THE CEILING HAD RAGGED EDGES, WE'D HAVE SNAPPED THE SMITHCRAFT TRIM FLANGE ON THE TROFFER REFLECTOR. THE SMITHCRAFT CEILING SUSPENSION SYSTEM COULD HAVE BEEN USED TO HOLD UP BOTH TROFFERS AND CEILING PANELS, TOO"

"THAT LOUVER PROVIDES 40° CUTOFF BOTH LENGTHWISE AND CROSSWISE"

"THE DUO-CAM HANGERS HINGE THE LOUVER FROM EITHER SIDE"

"FINGER-TIP PRESSURE OPENS OR COMPLETELY REMOVES THE LOUVER . . . NO SNAPS, SCREWS, OR TRICKY GADGETS"

"AND WITH ALL ITS ADVANTAGES, IT COSTS US NO MORE TO SPECIFY SMITHCRAFT"

"WHAT IF THAT CEILING WAS PLASTER?"

"WE'RE GOING TO HAVE A GOOD-LOOKING ROOM — WITH GOOD LIGHTING"

"OH, THE SMITHCRAFT PLASTER FRAME IS PERFECT. IT ASSURES SQUARENESS AND THE TROFFER FITS FLUSH WITH THE CEILING"

"WE'LL BE ABLE TO MAKE GEOMETRIC PATTERNS OF LIGHT WITHOUT COSTLY ACCESSORIES"

### Smithcraft

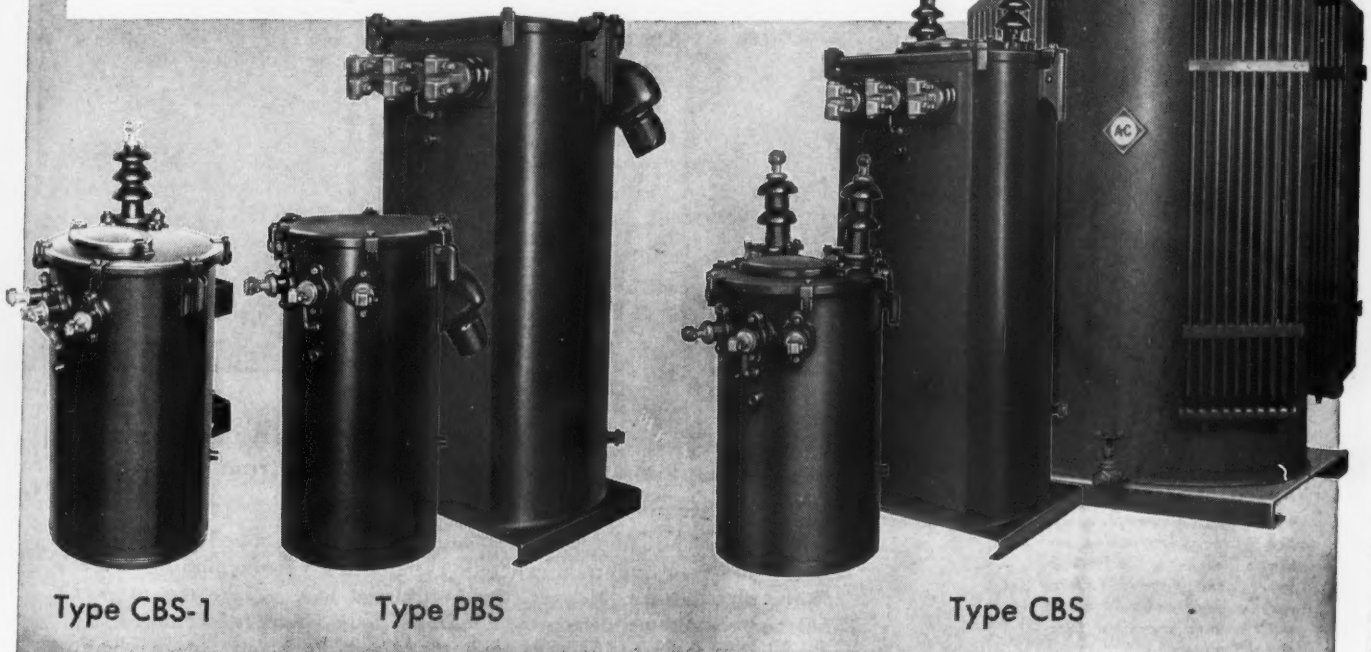
LIGHTING DIVISION  
CHELSEA 50, MASSACHUSETTS

# Select from Complete Line OF STANDARD RATINGS!

KVA	4800 VOLT AND BELOW	7200 VOLT AND UP
3-25	—	CBS-1
3-100	PBS	CBS
167-500	CBS	CBS

## KEY TO TYPE DESIGNATION

- CBS-1** Single high voltage cover bushing with low voltage stud bushings in tank wall.
- PBS** High voltage pocket bushings with low voltage stud bushings in tank wall.
- CBS** High voltage cover bushings with low voltage stud bushings in tank wall.



Type CBS-1

Type PBS

Type CBS

## Allis-Chalmers Distribution Transformers

EVERY RATING AND DESIGN of distribution transformer listed in the Fourth Report (1948) of EEI-NEMA can be supplied by Allis-Chalmers!

Size and weight of these transformers have been reduced as much as  $\frac{1}{3}$ , making them easier to handle during installation.

All tanks are given Spra-Bonderized surface treatment . . . a hot dip phosphate process which protects against corrosive atmospheres.

Heavy gauge steel tanks are seam welded and pres-

sure tested at 50 psi. to insure permanent protection against leaks.

For more details about these and other features of Allis-Chalmers distribution transformers, ask your nearby sales representative for the complete 12-point construction story. Or write for bulletin 6159A. A 2637

ALLIS-CHALMERS, 930A SO. 70 ST.  
MILWAUKEE, WIS.

# ALLIS-CHALMERS

Pioneers in Power and Electrical Equipment From Generation Through Utilization

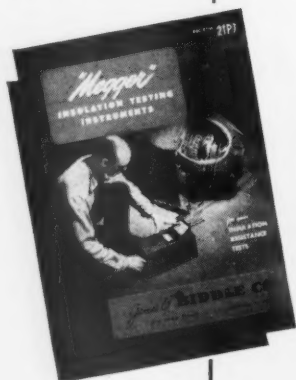




Maintenance needs the "MEGGER" tester  
as the surgeon needs his x-ray



• The photograph and the quotation in this advertisement are used by courtesy of the Pennsylvania Sugar Company of Philadelphia, and Dan Gutleben, who until recently was Chief Electrical Engineer.



REG. U. S. PAT. OFF.

**H**ERE'S what the chief engineer of a large sugar refinery—using its own generators and over a thousand motors from  $\frac{1}{4}$  to 150 hp—has to say about "Megger"\* Insulation Testers:

"Every Saturday... the Wizard (Chief Electrician) applied our 'Megger' Tester to all of our important generating equipment. Usually nothing happens... Then one day the 'Megger' test indicates a leak... Like the surgeon's X-ray the 'Megger' test detects the condition, and a failure is forestalled. With our insulation resistance records we further watch any progressive weakening of the 'arteries' and have warning that permits us to make repairs at convenient times... A maintenance gang without a 'Megger' tester would be like a surgeon without an X-ray machine."

Are you getting the benefit of this kind of insurance protection for the important electrical equipment in your plant? "Megger" Insulation Testers are available in various types (including the unique "Bridge-Meg" instrument here illustrated) with ratings up to 10,000 megohms and 2500 volts d-c. Write today for illustrated Bulletin 21P7-EC.

**JAMES G. BIDDLE CO.**

Electrical & Scientific Instruments

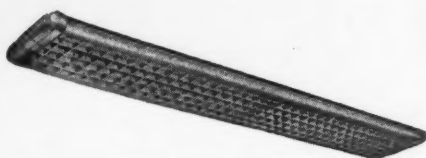
1316 ARCH STREET, PHILADELPHIA 7, PA.

# they're easier to sell...

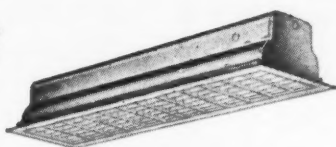
## UNDER *Leader*

### FLUORESCENT FIXTURES

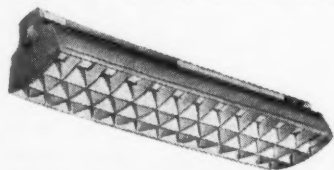
Millinery or motor cars, foods or furniture—all merchandise moves faster, with less sales effort, when correctly lighted. Because the Leader line of fluorescent fixtures for commercial use is complete and provides the right fixture for any installation, Leader fixtures are easier to sell, too.



NHC-480 Leader "New Horizon" with Slim-line tubes. Creates new opportunities for modern lighting, efficiently, with low maintenance costs, versatility of surface brightness, and higher illumination values.



TL-240 Leader "Trofferlite." With many new and exclusive features, Leader's new Trofferlite fixtures are ideal for remodeling or for new construction. For mounting as single units or in continuous rows.



SM-240 Leader "Schoolmaster." A newly styled fluorescent fixture for schoolroom use. Optional feature is a built-in germicidal lamp. The Schoolmaster is also ideal for commercial use.



VL-440 Leader "Officer" America's most beautiful fluorescent fixture. Wafer thin. White molded plastic destaticized louvers assure maximum soft light diffusion. May be mounted singly or in continuous rows.



Leader Adjustable "Direclite." May be mounted above a display case in a continuous run of "Officer" units... or with a single unit... to spotlight merchandise for added sales appeal.

*Better Light  
means  
Better Business*



Only better electrical wholesalers and contractors distribute and install Leader fixtures.

**LEADER ELECTRIC COMPANY**

3500 N. KEDZIE • CHICAGO 18, ILLINOIS

WEST COAST FACTORY: 2040 LIVINGSTON STREET • OAKLAND 6, CALIF.



See the Leader  
Lighting Exhibit at  
Booth 124

# HERE'S WHY

it costs you LESS  
to use the  
BEST WIRE CONNECTORS



**IDEAL**



Patented, No. 1,933,555

THE SOLDERLESS, TAPELESS WIRE CONNECTORS

The name "IDEAL" on a wire connector is more than just the name of the manufacturer. It is your assurance that you have the best, most economical wire connector you can buy. Here's why:

- 1 IT'S DEPENDABLE**—For more than 20 years electrical contractors have been doing better circuit and fixture wiring with "Wire-Nuts", the original mechanical type wire connector . . . Millions in use!



- 2 IT'S VIBRATION-PROOF**—As the "Wire-Nut" is screwed on, the helical cone spring insert automatically compresses the wires, twists them together and cross-threads them in one operation. A "Wire-Nut" connection is permanent!

- 3 IT HAS A SPECIAL SPRING STEEL INSERT** that gives maximum gripping power—copper coated for better electrical contact. This insert presses (does not cut) threads into the wire.



- 4 IT'S SAFE**—The molded Bakelite shell keeps the wire ends covered—prevents grounds or shorts. It is properly cured and inspected; will not crack, crumble or deteriorate. It is tested in a hot oil bath (300° F.) for one hour.

- 5 IT RESISTS PULL-OUT**—



A "Wire-Nut" connection of two No. 14 wires will stand up to 176-pound pull.

- 6 IT IS OF HIGHEST QUALITY**—from original materials to finished product. The highest precision standards are employed in its manufacture, testing and inspection. It is visually inspected for smooth edges, high polish, proper cure, clear molding of name and size.

- 7 IT IS APPROVED**—Listed by Underwriters' Laboratories, Inc. and approved by other leading electrical authorities.



**SCREWS ON—Like a Nut on a bolt!**  
No Solder, No Tape, No Tools



DISTRIBUTED THROUGH AMERICA'S LEADING WHOLESALERS

**IDEAL INDUSTRIES, Inc.** Sycamore, Illinois



# ARROW

## DUPLEX RECEPTACLES

### *Complete Line for General Installations*

No. 9260 — the *new* Back-Wired Duplex Convenience Outlet — can be side-wired too but the back-wiring feature makes easier, more secure installation. Built-in stripping guide assures correct stripping, eliminates exposed wire. Individual terminal clamps hold wires with a no-slip grip. Strong plastic base (No. 9260, brown; No. 9260-I, white Ivorylite), with double T-slots. Double side-contacts with large recessed binding screws ample for No. 10 wire; washer-type plaster ears. Altogether a new "high" in receptacles.

No. 1913-I — Duplex Convenience Outlet of white Ivorylite, with 4 binding screws for side-wiring only. T-slots and wide plaster ears. Long-proved a most dependable receptacle for high-grade residential wiring. (For brown plastic base, specify No. 1913.)

No. 400-I — New intermediate-grade Convenience Outlet, sturdily built, entirely encased in molded white Ivorylite. Double side-contacts with 4 contact screws ample for No. 10 wire. Parallel slots with guiding grooves for easy plug insertion; wide plaster ears. Meets REA and Federal specifications. (For brown plastic base, specify No. 400.)

No. 401 — Same receptacle body as No. 400 but furnished with metal outlet box cover for  $3\frac{1}{2}$ " or 4" boxes for basement work, private garages etc.

DISTRIBUTED THROUGH ELECTRICAL WHOLESALERS

## ARROW ELECTRIC DIVISION

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY, HARTFORD 6, CONN., U.S.A.

# 2 more 1 STS by Sheldon FOR 3 NEW FLUORESCENT LAMPS



AVAILABLE  
FOR  
IMMEDIATE  
DELIVERY!

## FS 25 FLUORESCENT STARTERS

*for use with*

- 33" 25 WATT and
- 18 WATT CIRCLARC Lamps

## FS 85 FLUORESCENT STARTERS

*for use with*

- 60" 85 WATT Lamps

Sheldon introduces the first, practical starters for these 3 new, highly efficient, long-life lamps which will revitalize the fluorescent industry for manufacturers, jobbers, dealers and contractors.

The FS 25 and FS 85 give FAST, EFFICIENT, SMOOTH, RELIABLE starter performance. The FS 85 will also work satisfactorily with the 60" 100 watt lamps.

Write for catalog.

**SHELDON ELECTRIC COMPANY, INC. IS PROUD OF THESE  
ADDITIONAL CONTRIBUTIONS TO THE INDUSTRY.**

**SHELDON ELECTRIC COMPANY, INC.**

THE WORLD'S LARGEST MANUFACTURERS OF THE MOST COMPREHENSIVE LINE OF FLUORESCENT STARTERS

68-98 Coit Street, Irvington 11, N. J.

Branch Offices & Warehouses:

CHICAGO 6, ILL.—626 W. Jackson Blvd.

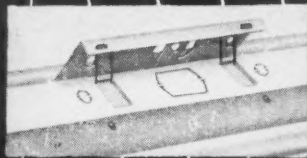
LOS ANGELES 6, CAL.—2559 West Pico Blvd.

# NOW! Improved **THREE WAYS!**

## *the Electro BASIC Unit*



NEW . . . Improved SPEEDY HANGER  
showing permanent suspension clips



**Seven distinctive ELECTRO luminaires**

**Adapted to New Basic Unit**

**Cut inventory costs 40% to 60%**

Improved ELECTRO BASIC UNIT has these  
NEW features:

- NEW permanent type suspension clips remain concealed in unit.
- NEW and improved type Speedy Hanger for easier installation—minimum maintenance cost.
- NEW modernized design for every conceivable method of hanging! . . . twin stem, single stem or flush . . . individual or continuous.

**INVENTORY down PROFITS up**

See it at 3rd International Light Show  
Exposition, Booths 49 and 50.

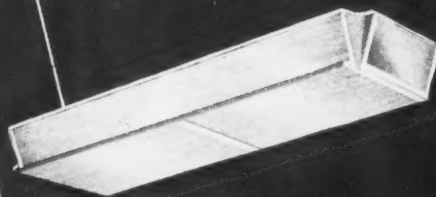
**NEW ELECTRO BASIC UNIT**

*A Basic Profit Maker*



• Model 1047  
Basic Unit 1040 + Kit No. 7

P-Kit  
for  
Twin Stem  
hanging  
S-Kit  
for  
Single Stem  
hanging



• Model 1041  
Basic Unit 1040 + Kit No. 1



• Model 1042  
Basic Unit 1040 + Kit No. 2



• Model 1043  
Basic Unit 1040 + Kit No. 3



• Model 1044  
Basic Unit 1040 + Kit No. 4



• Model 1045  
Basic Unit 1040 + Kit No. 5



• Model 1046  
Basic Unit 1040 + Kit No. 6



**ELECTRO MANUFACTURING CORPORATION**

**2000 West Fulton Street • Chicago**





Available in various combinations to meet specific requirements.

#### CATALOG NUMBERS

2 Wire	2 Wire	3 Wire
2 Pole	3 Pole	4 Pole



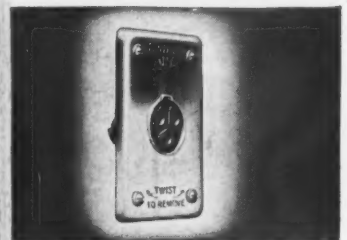
8712 8713 8714



8722 8723 8724



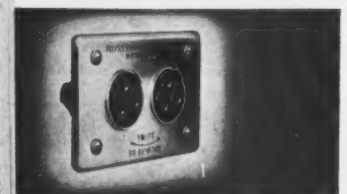
8702 8703 8704



8802 8803 8804



8732 8733 8734



8832 8833 8834

# AUTOMATIC LOCKING Midget EVER-LOK PLUGS, RECEPTACLES AND CORD CONNECTORS FOR COMMERCIAL AND INDUSTRIAL APPLICATION 10 AMPERES, 250 VOLTS — 15 AMPERES, 125 VOLTS — A. C. OR D. C.

Male plug interior in steel enclosure, cadmium plated finish. Complete with sponge rubber dust-tight bushing and cable grip. Maximum cable diameter 1/2 inch. Appr. net weight 1/4 lb.

Female connector interior in steel enclosure, cadmium plated finish. Complete with sponge rubber dust-tight bushing and cable grip. Maximum cable diameter 1/2 inch. Appr. net weight 1/4 lb.

Single receptacle complete with heavy gage steel cover with gasketed flap, cadmium plated finish. Fits types FS and FD conduit boxes. Appr. net weight 1/2 lb.

Single receptacle complete with heavy gage steel cover without flap, cadmium plated finish. Fits types FS and FD conduit boxes. Appr. net weight 3/8 lb.

Duplex receptacle complete with heavy gage steel cover with gasketed flaps, cadmium plated finish. Fits types FS and FD conduit boxes. Appr. net weight 5/8 lb.

Duplex receptacle complete with heavy gage steel cover without flaps, cadmium plated finish. Fits types FS and FD conduit boxes. Appr. net weight 1/2 lb.

Duplex receptacle complete with heavy gage steel cover with gasketed flaps, cadmium plated finish, and type FS single gang cast iron conduit box. Appr. net weight 3 5/8 lbs.

Duplex receptacle complete with .060 inch brass flush plate without flaps, brush brass finish. Fits standard 4 inch outlet boxes with raised covers. Appr. net weight 1/2 lb.

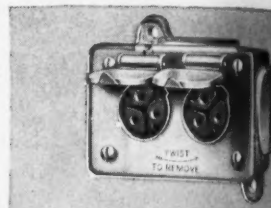
Single male receptacle interior in flanged steel casing, cadmium plated finish. Appr. net weight 1/8 lb.

Single receptacle complete with .060 inch brass flush plate without flap, brush brass finish. Fits standard 4 inch outlet boxes with raised covers, or single gang switch boxes having 2 inch minimum depth. Appr. net weight 3/8 lb.

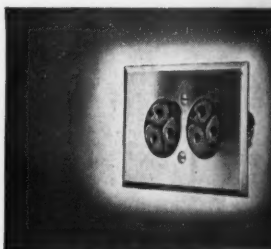
Single receptacle complete with cast aluminum conduit fitting and cover with gasketed flap, corrosion resisting finish. Tapped for 1/2 inch conduit, one way only. Appr. net weight 5/8 lb.

#### CATALOG NUMBERS

2 Wire	2 Wire	3 Wire
2 Pole	3 Pole	4 Pole



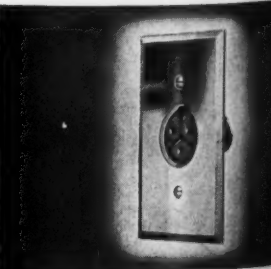
8772 8773 8774



8862 8863 8864



8942R 8943R 8944R



8842 8843 8844



8792 8793 8794

**Sold through Electrical Wholesalers**

**Sales Representatives in Principal Cities**

The new Automatic Locking Midget Ever-Lok Plugs, Receptacles, and Cord Connectors are designed for many applications where space is limited, or units of smaller size are desirable. Used wherever safe, reliable performance is vital, such as in business offices, hospitals, institutional buildings, and industrial plants. Readily adaptable for use as a component for all types of portable electrical equipment, including recorders, communication and sound equipment, electric machine tools, X-ray and medical apparatus, and many other types of equipment.

Write for new,  
12-page Catalog EL49-4.

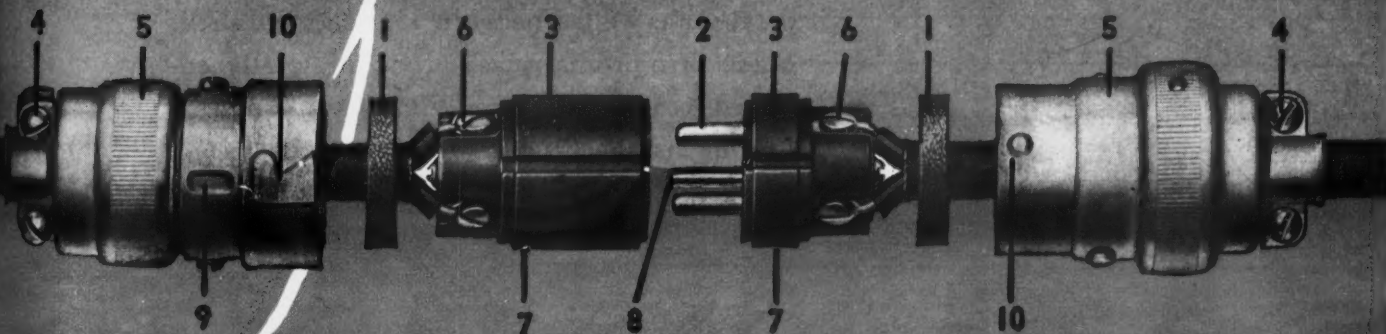
Midget Ever-Lok units embody all the dependable features of the well-known larger size Ever-Lok units, plus many advantages achieved by improvements in design and materials.

Russell & Stoll's leadership in the manufacture of precision-built electrical equipment is the result of over four decades of specialized engineering experience and skilled craftsmanship. R&S products are recognized everywhere as the standard of value for materials, workmanship, and quality.

The midget EVER-LOK plug is automatically locked when inserted into a midget EVER-LOK receptacle or cord connector. They can be readily unlocked by a twist of the wrist. The fool-proof bayonet type lock is simple and also serves to polarize the connectors. The spring action of the plug is durable and designed to give years of trouble-free service.

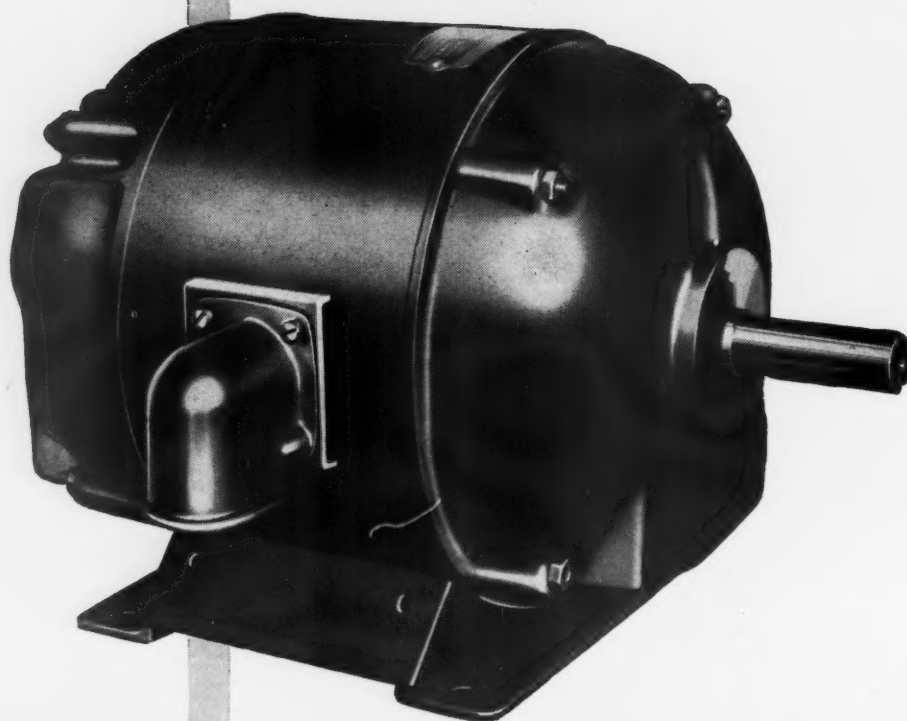
1. Dust-proof—A thick sponge rubber washer is provided in each cap, to be forced over the cord. This serves as a bushing and also as a shield to exclude metal particles, dust, etc., from interiors of Plugs and Connectors.
2. Contacts—Precision made, self-wiping, and self-aligning.
3. Interiors—All interiors of molded arc-resisting composition.
4. Cord Grip—Plugs and Connectors are provided with adjustable cord grips preventing strains on connections.
5. Entirely steel-clad—cadmium plated.

6. Terminals located for most convenient wiring.
7. Positive Grounding—Casings are positively grounded by springs insuring protection of workmen against accidental short-circuits.
8. Equipment grounding is secured by separate set of beryllium contacts which "make" first and "break" last (as required by Underwriters Laboratories).
9. Housings and Interiors are indexed for fool-proof assembly.
10. Polarized to prevent cross connections.



**RUSSELL & STOLL COMPANY, INC.**  
Precision-Built Electrical Equipment  
125 BARCLAY STREET, NEW YORK 7, N. Y.

SINCE  
1902



# PROTECTED!

## (INSIDE AND OUT)

Robbins & Myers Uni-Shell Motors, made with protected end-heads, are protected *inside and out*—from wind and weather; from overheating; from need for frequent attention. Extra-wide, sealed ball bearings require lubricating only *every five years*. Cooling air circulates through the rotor as well as between windings and shell. Made drip-proof, splash-proof, or totally enclosed in all motor types with *identical* mounting dimensions. Sizes to 30 h.p. Here's protected, dependable motor performance. Be sure you get it! *Prompt shipments*. Write for literature.

**R & M** *Uni-Shell* **MOTORS**

Authorized Distributors from Coast to Coast

**ROBBINS & MYERS, INC., Motor Division, SPRINGFIELD 99, OHIO**



# Now...A Classroom Lighting Installation Meeting or Bettering All Recommendations of American Standard Practice

An Engineering Report on Over-ALL Lighting by an Independent Consulting Illuminating Engineer.

Write for your copy.

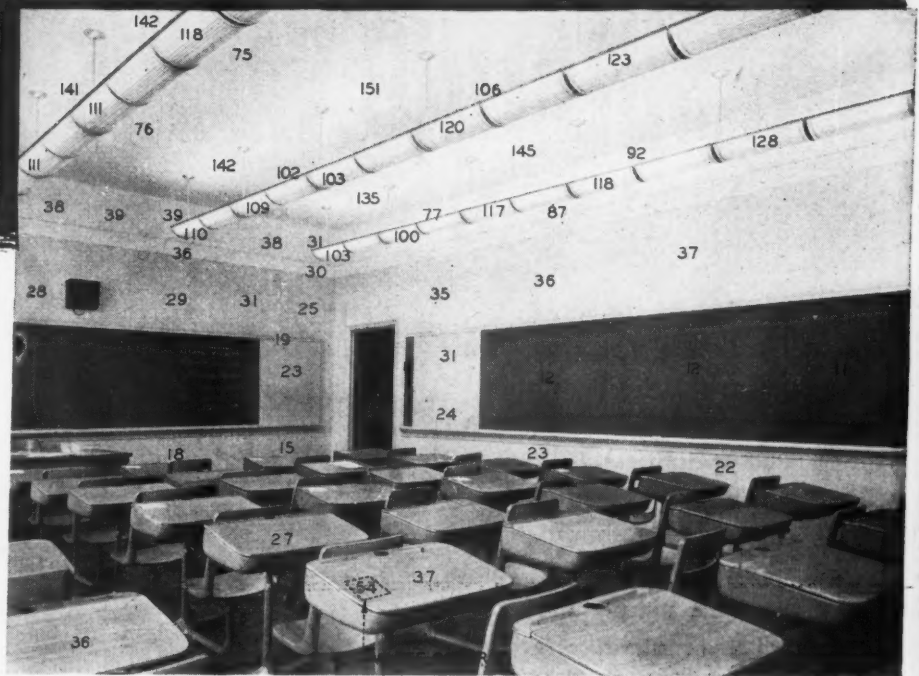
This is undoubtedly one of the first classrooms to be measured against the recommendations of American Standard Practice for School Lighting, sponsored by I.E.S. and A.I.A., and approved September 20, 1948. This child-conditioned classroom in John Simpson Junior High School, Mansfield, Ohio, meets or betters all artificial lighting requirements of American Standard Practice, as well as (with the exception of the floor) those of the National Council on Schoolhouse Construction.

**Description of Classroom:** Room 101, John Simpson Junior High School, Mansfield, Ohio. 30 feet long, 22 feet wide, 12 feet high. Ceiling white. Walls yellow and turquoise. Natural finish seating. Light green chalkboards. Ivory tackboards. Double row of diffusion screens mounted at windows.

**Lighting Installation:** Four continuous rows of two-lamp, 40W Wakefield Star units with luminous indirect plastic reflectors using 3500° white fluorescent lamps.

**Weather Conditions:** The survey was made on November 26, 1948, seven months after installation. The day was dark and cloudy with sky brightness so low the brightness of the diffuser at the window was approximately the same as that of the wall adjacent to it (66 footlamberts).

A copy of the complete detailed engineering report is yours for the asking. It is interesting to note that all equipment and materials used in this classroom are regularly available from manufacturers' stocks, and we will be glad to supply manufacturers' names, catalog numbers and descriptions of materials on request. Write to The F. W. Wakefield Brass Company, Vermilion, Ohio.



Comparison of Brightness Ratios

	Room 101 John Simpson Junior High School	American Stand- ard Practice for School Lighting	National Council on Schoolhouse Construction
Brightness of paper to brightness of desk top	1 to 1/1.6	1 to 1/3	1 to 1/5
Brightness of paper to brightness of floor	1 to 1/9	1 to 1/10	1 to 1/5
Brightness of paper to brightness of ceiling	1 to 2.78 (max.)	1 to 10	1 to 10
Brightness of luminaires to surfaces adjacent to them in the visual fields	3.4 to 1 (max.)	20 to 1	no recommendation
Brightness difference in the surrounding field between the brightest and darkest surfaces	10.5 to 1	no recommendation	50 to 1
Brightness difference in the peripheral field between the brightest and darkest surfaces	24 to 1	no recommendation	250 to 1
Lighting level	38 ft. c. lowest; 69 average	30 ft. c. min.	20 ft. c. min.

Comparison of Reflectances

	Above 85%	80 to 85%	85%
Ceiling	62 to 70%	50 to 70%	50% min.
Walls	48%	30 to 40%	40 to 60%
Trim	67%	50 to 60%	no recom.
Tackboards	24%	15 to 20%	30% max.
Chalkboards	30 to 55%	35 to 50%	30 to 40%
Desk Tops	22%	15 to 30%	30 to 40%
Floor			

## Wakefield Over-ALL Lighting

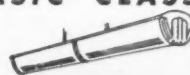
A BASIC CLASSROOM TOOL



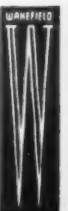
THE GRENADE II



THE COMMODORE



THE STAR



*To simplify your motor repairs*

# USE THIS NEW GENERAL-PURPOSE\* INSULATING VARNISH...

*G.E. 9574*

Here at last is a top-quality insulating varnish that you can use with real assurance in repairing **ALL TYPES OF MOTORS** (except extra high-speed armatures). It's General Electric's new 9574, developed after long research and careful testing under all kinds of operating conditions. These are some of the advantages that this material offers you:

## OUTSTANDING

### BONDING STRENGTH

Combines excellent adhesive properties with flexibility, plus extreme toughness and hardness. High-temperature bonding is excellent.

## UNUSUAL

### CHEMICAL RESISTANCE

Salt-water resistance—Excellent  
Alkali resistance—Excellent  
Acid resistance—Excellent  
Oil resistance—Excellent

## EXCELLENT

### ELECTRICAL PROPERTIES

Dielectric strength (volts/mil) 1800—2000.  
After 24 hours in water at 25 C (volts/mil) 700.

**Easier to use.** G-E 9574 is a phenolic drying-oil varnish. It's remarkably easy to handle, yet it gives maximum protection as a general-purpose insulation. High flash point (100 F). And its viscosity of 250 C. P. average (at 45 F) makes it usable at barrel gravity. No special thinners required—use petroleum spirits.

**Cures at low temperatures.** This clear-baking varnish cures at low temperatures. A baking cycle as low as 212 F

is satisfactory with conventional equipment. Also cures by infra-red.

**Try 9574 on your motors**—Simplify your repair work; note the exceptional resistance qualities it offers you to provide **LONGER LIFE** for the motors you repair. For more details, write for new bulletin to your local G-E Distributor or Section 22-3, Chemical Department, General Electric Company, Pittsfield, Massachusetts.

\*G-E 9574 gives excellent results on all types of coils except extra high-speed armatures.

*You Can Put Your Confidence in*

GENERAL  ELECTRIC

CD49-153

# HE'S USING

# TIREX

*Welding*  
**CABLE**



**AND WITH FOUR GOOD REASONS!!**

SIMPLEX-TIREX WELDING CABLES			
Size A.W.G.	Strands	Approx. Gross lbs. per 1000 ft.	Approx. O.D. Inches
4	1078	270	.50
3	1372	290	.50
2	1715	350	.56
1	2156	450	.63
1/0	2695	530	.68
2/0	3381	640	.75
3/0	4263	770	.82
4/0	5341	950	.90

Other sizes available from #8 to 1,000,000 C.M.

- 1. EXCEPTIONAL FLEXIBILITY.** The conductors of Simplex-TIREX Welding Cables, being made up of many threadlike copper wires properly stranded together, provide flexibility that cuts drag and wrist fatigue to the minimum and enables him to work with speed and efficiency.
- 2. CLEAN STRIPPING.** A separator of soft cotton braid between conductor and jacket assures him of clean, fast stripping.
- 3. DURABILITY.** The Selenium Neoprene jacket on TIREX Welding Cables is cured-in-lead for toughness. It furnishes long-lived protection against abrasion, oil, grease, acids, and heat.
- 4. SAFE HANDLING.** Selenium Neoprene Armor is not readily cut or torn and provides insulation that's electrically and mechanically stable. In addition, it is flame resistant.

Those are the features that can mean greater production, more-finished work, and lower operating costs on all of your electric welding jobs. For help in selecting the TIREX Welding Cable best suited to your requirements, drop us a line at the address below or call in the Simplex representative in your area.

## ***TIREX WELDING CABLES***

**SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.**

ATLANTA - CHICAGO - CLEVELAND - DETROIT - LOS ANGELES - NEW ORLEANS - NEW YORK - PHILADELPHIA - PITTSBURGH - RALEIGH - SAN FRANCISCO - SEATTLE

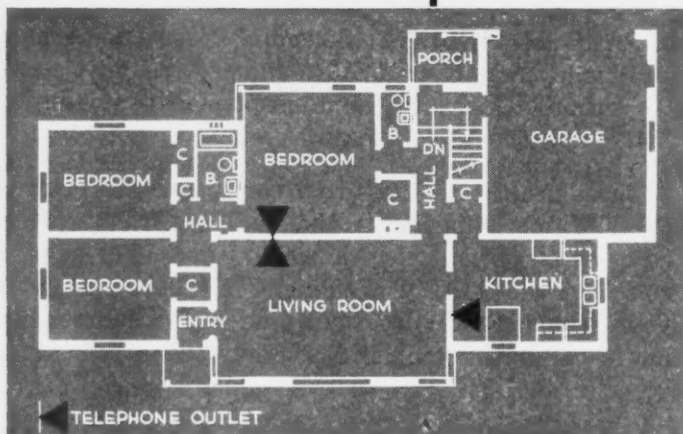
ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . MARCH, 1949





Arthur F. Moratz, Architect, Bloomington, Ill.

## **"SOUND" PLANNING CALLS FOR BUILT-IN TELEPHONE RACEWAYS**



A "Telephone Planned" home means concealed telephone wires, and preplanned, conveniently located telephone outlets for the owner. It also means extra profits for you.

Telephone raceways are being included in homes of all sizes today to carry telephone wires inside the walls to built-in outlets.

Remember — NO ELECTRICAL CONTRACT IS REALLY COMPLETE UNLESS IT CONTAINS RACEWAYS FOR TELEPHONE WIRES.



**BELL TELEPHONE SYSTEM**



# SAVE . . .

## WITH UNDERGROUND INSTALLATION



### Roebling Paper Insulated Cable

#### YOU WIN WHEN YOU ABOLISH OVERHEAD LINES

YOU'VE EVERYTHING TO GAIN and nothing to lose (except costly maintenance and eyesores) when you abolish overhead lines. Today's best practice is to put circuits underground . . . and to install Roebling Paper Insulated Lead Encased Cables for long,

uninterrupted service at lowest cost.

Roebling Shielded Type H is outstanding for 3-phase grounded neutral circuits from 13 to 33 kv. It comes in both single and multiple conductor construction, in regular and Compact strand (round or sector). Conductors

are shielded with metallized paper, individually insulated, protected with perforated copper shielding tape, and then the whole assembly served with a bronze binder tape and lead sheathed.

Your nearest Roebling office and sales engineer will be glad to help you choose the *right* cable for your specific service. John A. Roebling's Sons Company, Trenton 2, New Jersey.

— WRITE OR CALL THE ROEBLING FIELD MAN AT YOUR NEAREST —  
ROEBLING OFFICE AND WAREHOUSE

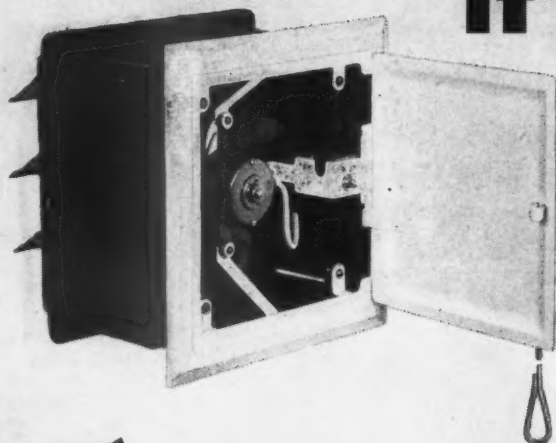
Atlanta, 934 Avon Ave. ★ Boston, 51 Sleeper St. ★ Chicago, 5525 W. Roosevelt Rd. ★ Cleveland, 701 St. Clair Ave., N. E. ★ Denver, 1635 17th St. ★ Houston, 6216 Navigation Blvd. ★ Los Angeles, 216 S. Alameda St. ★ New York, 19 Rector St. ★ Philadelphia, 12 S. 12th St. ★ Pittsburgh, 855 W. North Ave. ★ Portland, Ore., 1032 N. W. 14th Ave. ★ San Francisco, 1740 17th St. ★ Seattle, 900 First Ave.

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☆ A CENTURY OF CONFIDENCE ☆

**For Healthful...Controlled...  
LOW - COST Ventilation!**

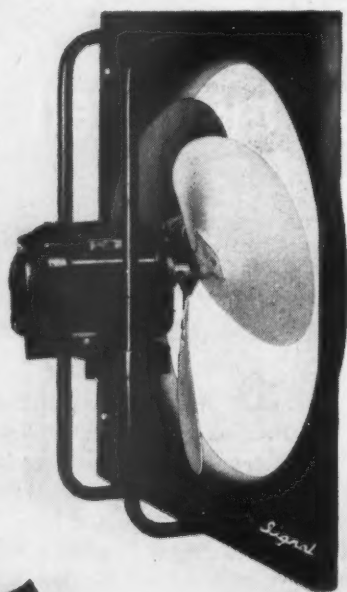
it's *Signal*



*Signal*

### KITCHEN VENT FANS

Fit varying wall thicknesses 6" to 24"; automatic operation; 10" blade; rubber mounted, self-lubricating motor is fully enclosed.

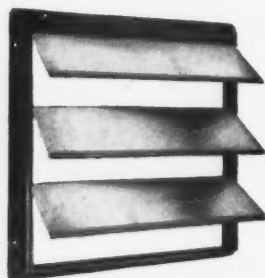


*Signal*

### CHALLENGER VENT FANS

Five sizes—10", 12", 16", 20", and 24"; continuous duty motor, fully enclosed; porous bronze, self-lubricating bearings.

New construction or remodeling calls for planned ventilation. Yes, hard working breezes are now built-in where you want them—in kitchens, recreation rooms, attics and utility rooms. *Signal* vent fans have a performance - proven reputation for being dependable, quiet, economical and EASY TO INSTALL. Men who know, specify *Signal*. Write for free catalog, or get all the details from your *Signal* supplier today!



**AUTOMATIC SHUTTERS**  
Provide outside protection for *Signal* Exhaust and Vent Fans.



**TWO - SPEED SWITCH**  
Available with *Signal*'s Challenger Line Vent Fans.

*Signal*

**SIGNAL ELECTRIC MFG. CO.**

Dept. C-2, Menominee, Michigan



RACO has **3** Important Friends  
for *good Reasons*



...Architects



...Contractors



...Jobbers

1. **QUALITY**—RACO boxes are constantly inspected—therefore, dimensions are true—tapped holes are exact—k'o's are clean—the finish, whether black or galvanized, gives maximum protection.
2. **DEPENDABILITY**—RACO materials are approved by Underwriters! Every box goes into the job. Brackets are secure, the clamps hold, and devices are easily and securely installed.
3. **COMPLETENESS**—RACO supplies a complete, practical line of boxes and covers, at all times for both commercial and home wiring.

You can always rely on RACO!

# RACO

ALL-STEEL PRODUCTS

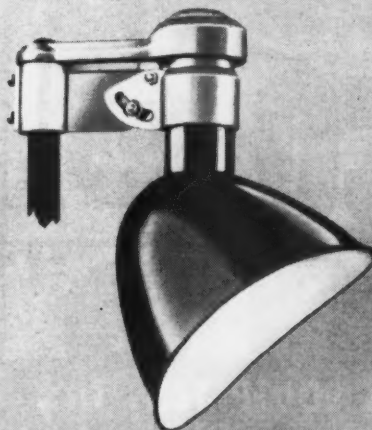
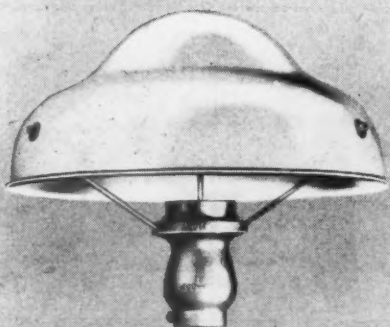
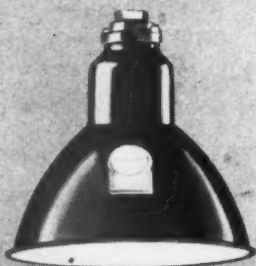
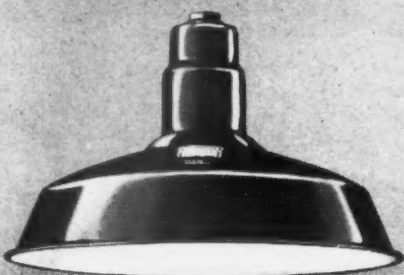
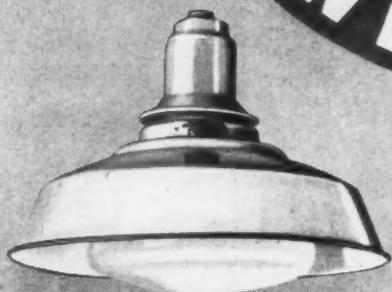
**ALL-STEEL EQUIPMENT Inc.**—800 Kensington Ave., Aurora, Illinois

**"A BOX FOR EVERY NEED"**

# ABolite

... the Improved Reflector  
they're calling

# WHITER *than* WHITE



While JONES ABolite Reflectors have always been considered the finest porcelain enamel-on-steel, now they are whiter, brighter, more efficient than ever. A new-process white, coupled with our new, continuous-enameling furnaces and more positive fusing controls, has brought this amazing new finish.

This new white greatly increases the reflecting quality of these lights, giving them the highest illumination factor possible with this type of reflector. ABolite's smooth, glass-like surface is easier to clean, requires less time to maintain at top efficiency.

The RLM label on an ABolite reflector is assurance it conforms to rigid specifications set by the RLM Standards Institute, of which Jones is a member.



ABolite Reflectors are made in a variety of types and designs for every kind of indoor and outdoor lighting. Many improvements in ABolite reflector holders have made these reflectors the most economical to install and maintain. This is especially true in ABolite Duo-Move system of maintenance.

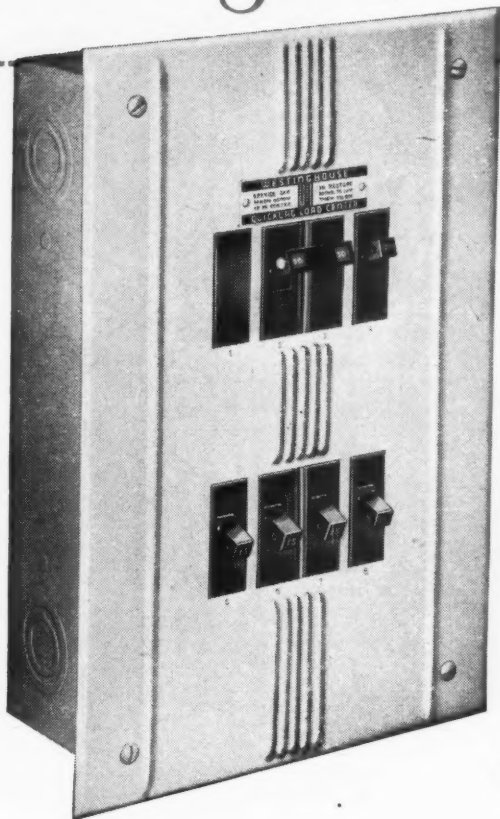
Write for **FREE SAMPLE DISC** which shows our improved "Whiter than White" porcelain enamel. Ask for catalog or see your Wholesaler for complete information.

See Us at —



THE JONES METAL PRODUCTS CO. West Lafayette, Ohio

YOU CAN BE **SURE**.. IF IT'S  
**Westinghouse**



## ANNOUNCING THE **NEW** QUICKLAG LOADCENTER



### Dependable Protection with "job-site" Flexibility

The new Quicklag Loadcenter has the kind of features you've wanted most in a modern, fuseless protective device, Flexibility, for example: With only a minimum stock of basic components, you can tailor the Quicklag Loadcenter to fit the circuit requirements of any home . . . and you can do it *on the job!* If the breakers in the loadcenter are not the desired capacity, you need only replace them with properly rated units. The breakers simply snap into place.

The Quicklag design assures maximum dependability by providing combined thermal-magnetic action. Two tripping forces are employed to assure positive operation on shorts or sustained overloads regardless of the frequency of their occurrence.

Dependable operation . . . "job-site" flexibility;

these are features that help you to be sure . . . sure of doing the kind of job that will provide lasting benefits for you and the home builder alike.

J-60691

Booklet B-3881, just off the press, explains every advantage of Quicklag Loadcenters. Your nearest Westinghouse office will supply a copy or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.



# Westinghouse

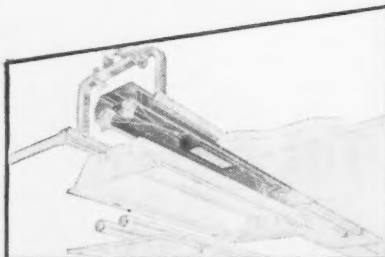
## QUICKLAG LOADCENTERS





## Important reasons for specifying miller fluorescent troffer lighting systems

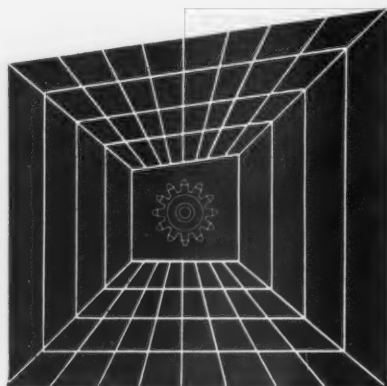
2



The patented Miller Ceiling Furring Hanger simplifies installation — makes it possible to arrange Troffers to form ceiling patterns as desired — **CEILINGS UNLIMITED\***. Channels are Bonderized for rust resistance.



Miller Troffers arranged in rectangular ceiling patterns with adjustable spots to high-light displays.



MILLER Troffer installations result in a finished lighting and ceiling job, adequate in illumination, architecturally pleasing, structurally sound and economically produced. Their versatility of application increases the functional value of lighting.

MILLER LIGHTING SERVICE IS ALL-INCLUSIVE covering needs of planned commercial and industrial lighting. Miller field engineers and distributors, conveniently located, are at your call.

**THE miller COMPANY**  
SINCE 1844

ILLUMINATING DIVISION, MERIDEN, CONNECTICUT

ILLUMINATING DIVISION: Fluorescent, Incandescent, Mercury Lighting Equipment. HEATING PRODUCTS DIVISION: Domestic Oil Burners and Liquid Fuel Devices. ROLLING MILL DIVISION: Phosphor Bronze and Brass in Sheets, Strips and Rolls.

\*Reg. Trademark U. S. Pat. Off.



*Your Central Conduit Distributor* will do everything possible to meet your demands

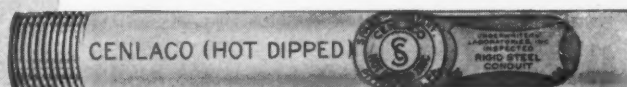


• Your Central Conduit Distributor has a modern, efficient operation. But he hangs on to one old fashioned precept . . . *the customer is king*. He is always ready to go-the-limit when it comes to service. At times, due to conditions beyond his control, he may ask you to accept partial deliveries. That's his way of making sure that everyone gets a fair share of his supply of Central Rigid Steel Conduit.

Whenever you need conduit or other electrical supplies, call your Central Conduit Distributor first. Tell him what quantities and sizes you'll need as far in advance as possible. Your Central Conduit Distributor will do his best to meet your requirements.

## SPANG-CHALFANT

Division of The National Supply Company  
General Sales Office: Grant Bldg., Pittsburgh, Pa.  
District Offices and Sales Representatives in Principal Cities



CENTRAL LACO a hot dipped galvanized and lacquered finish, inside and out.

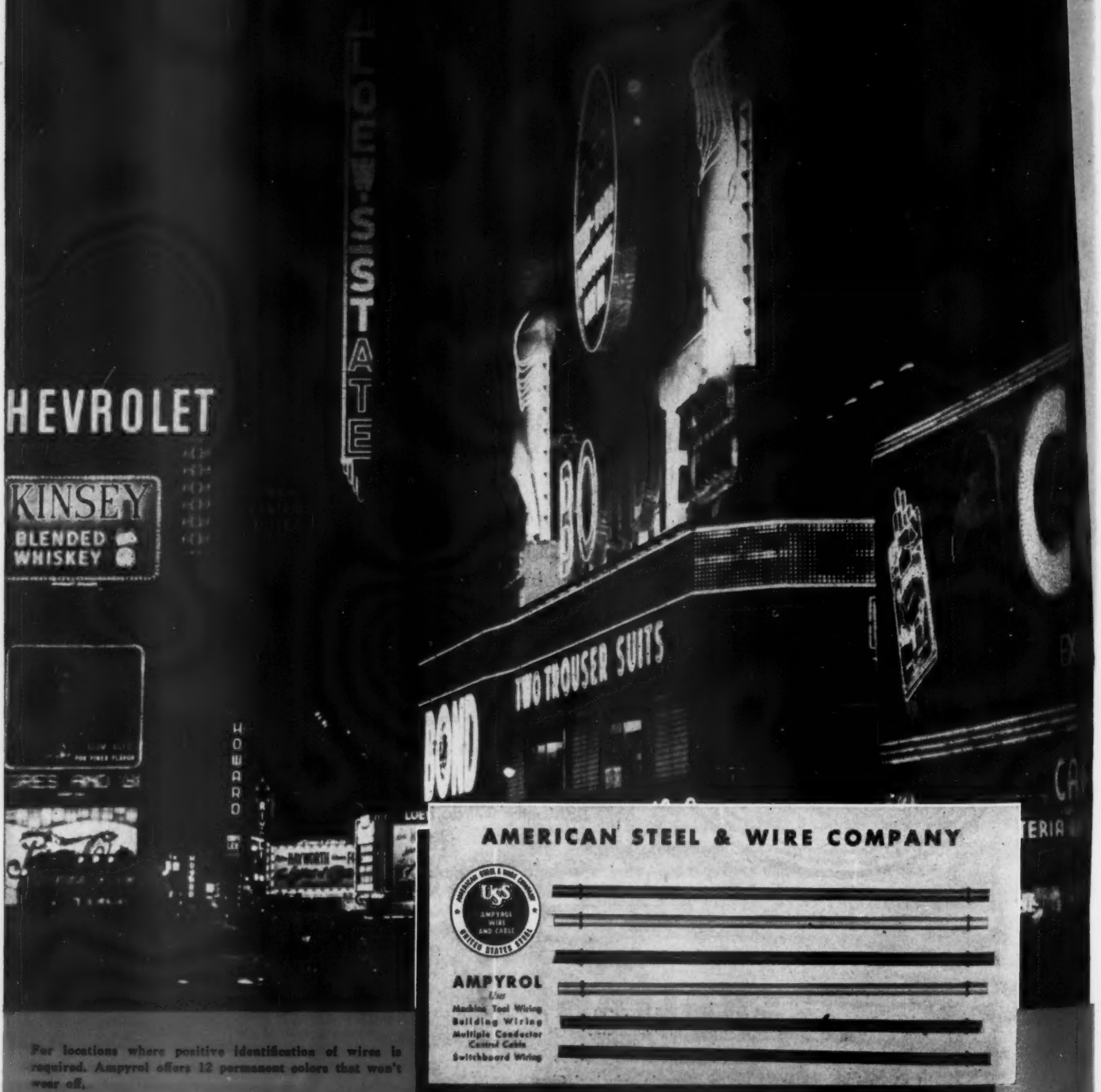


CENTRAL WHITE electro-galvanized outside and black enameled inside.



CENTRAL BLACK permanent, baked-on black enamel finish, inside and out.

# Spectacular jobs call for




**CHEVROLET**

**KINSEY**  
BLENDED  
WHISKEY

**FLOWER STATE**

**TWO TROUSER SUITS**

**AMERICAN STEEL & WIRE COMPANY**



**AMPYROL**  
Liner  
Machine Tool Wiring  
Building Wiring  
Multiple Conductor  
Control Cable  
Switchboard Wiring

For locations where positive identification of wires is required, Ampyrol offers 12 permanent colors that won't wear off.



# a Spectacular Cable

## U·S·S AMPYROL

Where you can cut costs by using  
U·S·S Ampyrol Wire and Cable



For switchboards and control apparatus where space is at a premium.

For re-wiring jobs where increased capacity is needed and conduits can't be torn up.

For locations where the wiring may encounter oil, grease, chemical fumes or acids.

For damp locations in basements or aboard ship where mold and fungus might ruin other insulation.

Sun doesn't crack it

Water doesn't harm it

Oil doesn't rot it

**I**F you have any doubt about what wire and cable to use for a tough job—investigate U·S·S Ampyrol. This versatile cable can be exposed to all kinds of weather. It will stand acids, alkalis, oil, ozone and many common solvents. It does not support combustion, has excellent aging qualities and remains flexible without cracking.

Ampyrol is a polyvinyl chloride insulation made by a special process developed at American Steel and Wire Company. The resulting product is uniformly high in quality and physical characteristics.

Because of its high dielectric strength, Ampyrol insulated wire has a much smaller diameter than rubber covered wire. You can't beat it for use on re-wiring jobs where increased capacity is needed but the conduit cannot be increased in size. Ampyrol is widely used for outdoor signs, radio and electronic equipment, switchboards, control apparatus, motor leads, and dozens of other tough applications.

If you have a difficult wiring job where the insulation should be chemically inert—try U·S·S Ampyrol. It is available in single wires or in cables which can be made to fit your needs. Write for complete information.

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO

COLUMBIA STEEL COMPANY, SAN FRANCISCO

PACIFIC COAST DISTRIBUTORS

TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM

SOUTHERN DISTRIBUTORS

UNITED STATES STEEL EXPORT COMPANY, NEW YORK



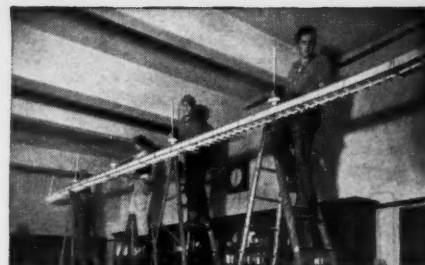
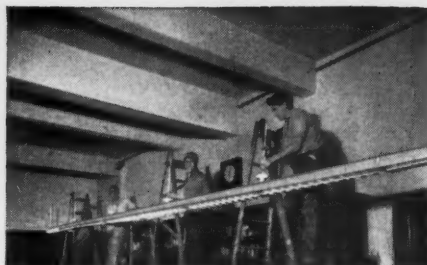
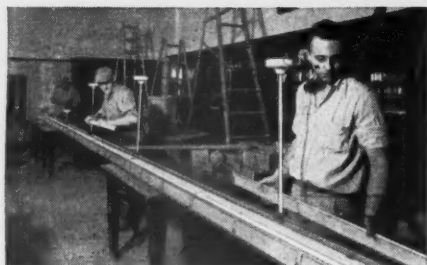
## Ampyrol Wire and Cable

UNITED STATES STEEL



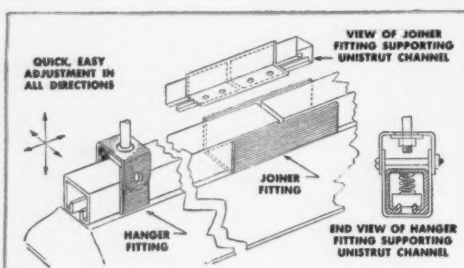
There's no better way to suspend

*Fluorescent  
Fixtures!*



Photographs illustrate the ease and speed with which fixtures are assembled to Unistrut at normal working height, then raised as one unit for suspension. Three minutes after picture at extreme right was taken, installation had been completed.

Installed by Wadeford Electric Co., Chicago, at Oak Park Township High School, Oak Park. Consulting Engineers—Neiler, Rich & Bladen, Chicago. Fixtures by Curtis Lighting Inc., and F. W. Wakefield Brass Co.



New Unistrut Hanger Fitting and Joiner Fitting for quick, easy fixture hanging. Eliminates drilling—allows extreme freedom of adjustment in all directions. A single bolt securely locks clamp to Unistrut.

**4** reasons why

**"UNISTRUT"**  
ALL-PURPOSE METAL FRAMING

makes fixture hanging easier  
and results in a better installation

**1 FEWER HANGER RODS**

Hanger rods may be spaced as far as 15 feet apart, resulting in lower costs and a better appearing installation.

**2 PERFECT ALIGNMENT**

Unistrut is perfectly rigid and straight—results in true alignment of fixtures. Standard lengths 10 and 20 ft.

**3 FASTER, EASIER INSTALLATION**

Entire run of fixtures can be quickly assembled to Unistrut *before* raising completed unit to ceiling for suspension.

**4 COMPLETELY FLEXIBLE**

Hangers may be installed at *any* point along Unistrut continuous slot channel. Allows greater adjustment—easier alignment and leveling of fixtures.

Unistrut has hundreds of other uses—completely adjustable and 100% re-usable!



Send for Pamphlet No. 26  
"Unistrut Method of Supporting  
Fluorescent Lighting Fixtures"

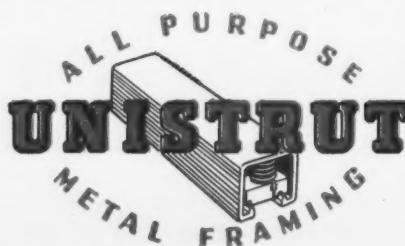
UNISTRUT PRODUCTS COMPANY  
1013 W. WASHINGTON BOULEVARD  
CHICAGO 7, ILLINOIS

Name \_\_\_\_\_

Firm Name \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_



Representatives  
in all Principal Cities

**UNISTRUT PRODUCTS COMPANY**

1013 W. WASHINGTON BLVD., CHICAGO 7, ILL.





# Get Action **LIKE THIS:**

- ★ 24 hours to make and install coils in 250 HP motor
- ★ Rebuilt 250 HP slip ring motor in 2½ days
- ★ 3 days to rebuild 125 HP motor including 200 miles of truck shipment

THESE ARE ACTUAL JOBS turned out by Giles Armature and Electric Works, Marion, Illinois . . . the kind A-C Certified Service Shops are doing every day!

When every hour costs money . . . when production is stopped . . . Allis-Chalmers

ALLIS-CHALMERS, 930A SO. 70 ST.  
MILWAUKEE, WIS

Certified Service on motors, transformers, pumps, etc., can get you rolling again, *fast*. Dependable for prompt service on routine work, too.

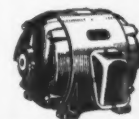
**Call Your A-C Office or Dealer.** A-C Certified Service Shops are hand-picked, independent repair shops meeting rigid standards for equipment, trained personnel and business reputation for square dealing. For the one nearest you, ask your Allis-Chalmers Dealer or District Office.

Check with us for *new* motors too. Stock or quick delivery on many sizes, types.

*Texrope* and *Vari-Pitch* are Allis-Chalmers trademarks. A 2594

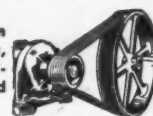
**Sold . . .  
Applied . . .  
Serviced . . .**

by Allis-Chalmers Authorized Dealers, Certified Service Shops and District Offices throughout the country.



**MOTORS** — ½ to 25,000 HP and up. Matching Allis-Chalmers Control.

**TEXROPE** — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.



**PUMPS** — Integral motor and coupled types. Sizes and ratings to 2500 GPM.

# ALLIS-CHALMERS





# Save with modern distribution systems using **WESTINGHOUSE** Dry-Type Transformers

If you are expanding or relighting your plant, you can lower operating costs and gain greater efficiency feeding motors and lights by using a modern distribution system.

In such a system, higher voltages are brought close to the load and are stepped down at the motors and lights they serve with modern, dry-type transformers.

*You will:*

**GET BETTER REGULATION  
SAVE COPPER  
SAVE INSTALLATION COSTS  
REDUCE OPERATING EXPENSES**

And Westinghouse dry-type transformers will give you additional advantages of **SMALL SIZE AND LIGHT WEIGHT**, important to the men who actually install the transformers.

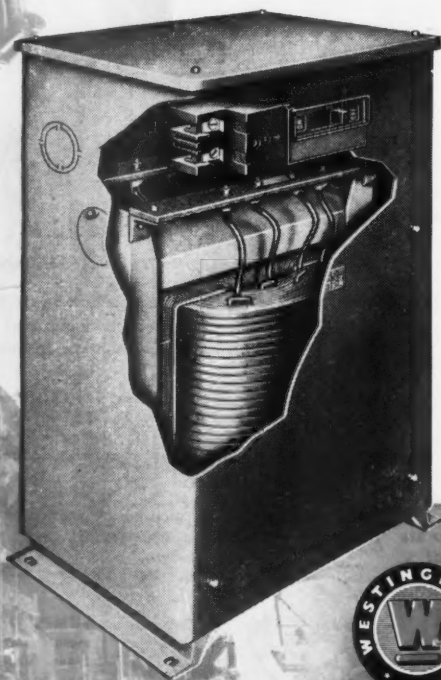
To get these extra "plus" advantages, Westinghouse leadership in engineering introduced Class B insulation and developed HIPERSIL\*, the steel that carries one third more magnetic flux.

That same engineering is ready to assist you with the proper application of dry-type transformers in the distribution system best suited to your needs. Call or write your near-by Westinghouse office for your copy of Booklet B-4009. Westinghouse Electric Corporation, Transformer Division, Sharon, Pennsylvania.

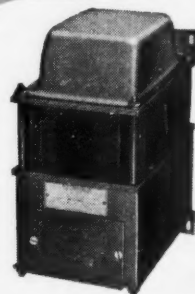
\*Reg. U. S. Pat. Off.

J-70517

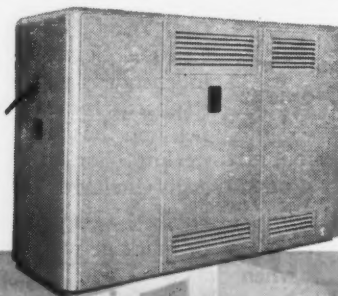
**YOU CAN BE SURE  
IF IT'S Westinghouse**



**A NEW FEATURE**—Two popular dry types, AJR and AVR, are now offered with or without a built-in circuit breaker. With this new feature, the need for separate protective devices is reduced. AVR-B (with breaker) is shown at left.



**ABOVE**—Type GP which, with type MT, are small, class A insulation transformers serving loads under 2 kva.



**LEFT**—Dry-type power center, used indoors as part of modern industrial distribution.



**Westinghouse**  
PLANTS IN 25 CITIES... OFFICES EVERYWHERE

**\* LEADERSHIP IN TRANSFORMER DEVELOPMENT  
... FOR EVERY POWER DISTRIBUTION JOB \***



*Tie This!*

## A LOW-COST GLASS CORDAGE that offers these 6 Major Advantages.

- IT Possesses Very High Breaking Strength
  - IT Will Not Rot
  - IT Possesses Good Moisture Resistance
  - IT Will Not Stretch or Shrink
  - IT Resists Oils, Corrosive Fumes and Most Acids
  - IT Is the Lowest Cost Cordage on the Market
- Combining all of these Plus Advantages

Fiberglas\* Cordage, made by plying fine, strong, flexible filaments of glass into cord, offers to manufacturers of electrical equipment and to repair and rewind shops the superior electrical and physical qualities of glass, the ideal inorganic insulating material.

Recommended for use in *all* electrical equipment—wherever a *low-cost* binder twine or high-strength tension member is required. It is used:

- For banding field and armature coils
- For wrapping string bands on small armatures
- For protecting front of the commutator V-ring
- For reset strings
- For tying slot insulation in place
- As binding on the V-ring extension
- As filling in winding coils
- To lash ends of coils in large motors and generators

As lacing cord (wax-treated) it is used:

- For assembling and tying wire harnesses.

Available, through leading electrical distributors, in sizes ranging from .014" to .154" in

diameter, either treated or untreated. Treatments—oil, neoprene or wax.

*Try it! Tie it!* Just fill in and mail the coupon below for more complete information and a sample of this low-cost, high-quality cordage. Owens-Corning Fiberglas Corporation, Toledo 1, Ohio. Branches in principal cities. In Canada: Fiberglas Canada Ltd., Toronto, Ontario.

### MAIL COUPON FOR COMPLETE INFORMATION

Owens-Corning Fiberglas Corporation  
Department 856  
Toledo 1, Ohio

Please send me more information and a sample of Fiberglas Cordage.

Name \_\_\_\_\_ Title \_\_\_\_\_

Company \_\_\_\_\_

Street and Number \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

\*FIBERGLAS is the trade-mark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with glass fibers.

OWENS-CORNING  
**FIBERGLAS**

ELECTRICAL  
INSULATING  
MATERIALS

**NEW**  
**WESTON**

**MODEL 901 SERIES**  
**A-C AND D-C PORTABLES**



*the modern concept*  
**in READABILITY...**  
**in SHIELDING!**

**D**esigned...and styled...to bring you Weston's concept of the finest general purpose portables ever produced! These instruments are offered with full assurance that their dependability will reflect credit upon the name they bear. Write for Circular A-22-A. Weston Electrical Instrument Corp., 617 Frelinghuysen Ave., Newark 5, N. J.

**WESTON**  
**INSTRUMENTS**

Albany • Atlanta • Boston • Buffalo • Charlotte • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Houston • Jacksonville • Knoxville • Little Rock • Los Angeles • Meriden • Minneapolis • Newark  
New Orleans • New York • Orlando • Philadelphia • Phoenix • Pittsburgh • Rochester • San Francisco • Seattle • St. Louis • Syracuse • Tulsa • In Canada, Northern Electric Co., Ltd., Powerite Devices, Ltd.



there are **6** good reasons for using **MULTI-BREAKERS** to build bigger, better, more profitable wiring jobs!



## Reason #1 ... an Ever-Growing MARKET

Compare the electrical appliances available for today's home with those of only a few years ago! That's only the beginning—think of the ones to come! Home owners want these appliances and they need an electrical system that can handle them. That's where you come in.

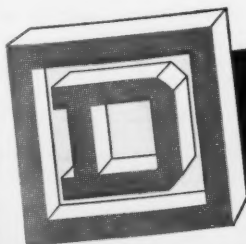
Sell the Multi-breaker idea of complete circuit protection in addition to adequate wiring. That's the one way of preventing overloads, annoying service interruptions, and the nuisance of replacing burned-out parts. You are building the market for your services when you help your customer take full advantage of "electrical living" by installing Multi-breakers.

Would you like to know the five other reasons?  
Write the Square D Company, 6060 Rivard St.,  
Detroit 11, Michigan. We'll mail them, pronto.

### SQUARE D's *Coilless* Thermal- $\Lambda$ Magnetic MULTI-BREAKERS

Give Complete Circuit Protection  
and Customer Satisfaction  
...because they

- hold harmless momentary overloads but trip on continuous overcurrents before wire insulation is damaged.
- trip quickly on "shorts" to localize damage.
- give repeat protection. No parts burn out—nothing to replace.
- are non-tamperable. Factory test-tripped and sealed.
- are safe. No live parts exposed. Anyone can operate them.
- include switching means as well as circuit protection.
- are compact. Room for expansion without excessive space.
- are attractive. Can be installed in most convenient location.



# SQUARE D COMPANY

DETROIT

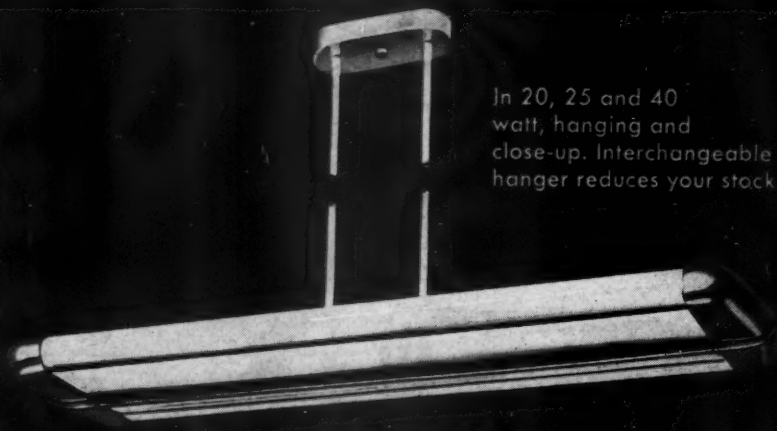
MILWAUKEE

LOS ANGELES

SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

# **NEW LYTRONS**

by **LIGHTOLIER**



In 20, 25 and 40 watt, hanging and close-up. Interchangeable hanger reduces your stock.

## **GOOD TO LOOK AT**

NEW die-cast ends

PERMANENT

Chromium and  
Lumino-White Finish

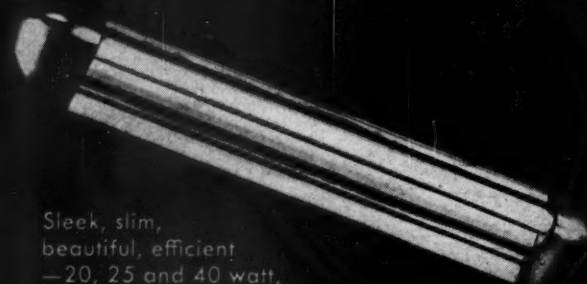
CLEAN, CRISP,  
SHALLOW DESIGN

## **BETTER TO SEE BY**

NEW, modified parabolic curved reflectors

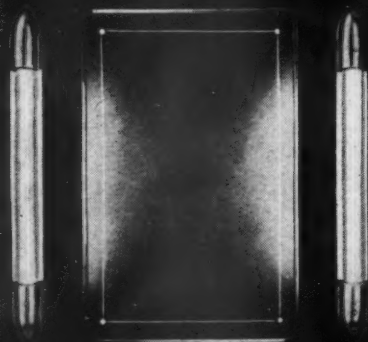
SCIENTIFICALLY spaced bulbs

ENGINEERED for maximum light output



Sleek, slim,  
beautiful, efficient  
—20, 25 and 40 watt,  
high and low power factors.

In 14 and 15 watt—keyless, outlet pull, outlet keyless, for design-coordinated supplemental lighting.



## **EASIER TO INSTALL AND MAINTAIN**

NEW snap-on covers

NEW slip-on ends

NEW, INTERCHANGEABLE fixtures and hangers

NEW, SOLO'STALL "one-man" hanger

NEW SIZE, 25 watt, as well as 20 and 40 watt, in both high and low power factors.

Attach this slip to your letterhead or business card and mail to **LIGHTOLIER**, Dept. W-3, JERSEY CITY 5, N. J., for complete Lytron catalog and profit-making plan.



# **LIGHTOLIER**

Jersey City, N. J.



# You know you're right with "G-E White"



These are five of the reasons why General Electric white rigid conduit is such a general favorite with electrical contractors and maintenance men everywhere.

Always, when you think of conduit for protection from atmospheric corrosion, think of "G-E White." For further information, see your nearest General Electric Construction Materials distributor, or write to Section C21-318, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.

\*Trade-mark Reg. U. S. Pat. Off.

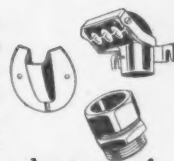
**GENERAL  ELECTRIC**

## RACEWAYS ROUNDUP with your GENERAL ELECTRIC Construction Materials Distributor



Where chemical corrosion is a threat to wiring, specify General Electric black rigid conduit. "G-E Black" is made from the same high grade steel as "G-E White." "G-E Black" is treated with a protective coating of tough, black enamel, baked on at high temperature. This hard, glassy-smooth finish makes wire pulling easy, and is an excellent paint base.

Service entrance cable fittings in a wide variety are available from General Electric. This line includes a large selection of the popular types of waterproof entrance caps, sill plates, cable straps and water-tight connectors.



If you're wondering how to get raceway protection for wiring in cramped quarters, for machine tool or temporary wiring, General Electric flexible steel conduit is the answer. This conduit is strong, yet very flexible. It's quickly installed, and the zinc-coated strip steel is wound in a way that makes wire pulling easy.

Your General Electric distributor can save you lots of time and trouble when you order wiring materials. Because



he carries the complete General Electric line, you can order every item you need from him. One order does it — no running around getting part of your order in one place and part in another. It's the kind of "one-stop, one-package" service busy contractors need to help stretch scarce working hours.

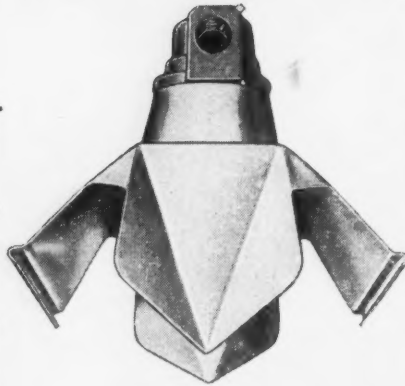
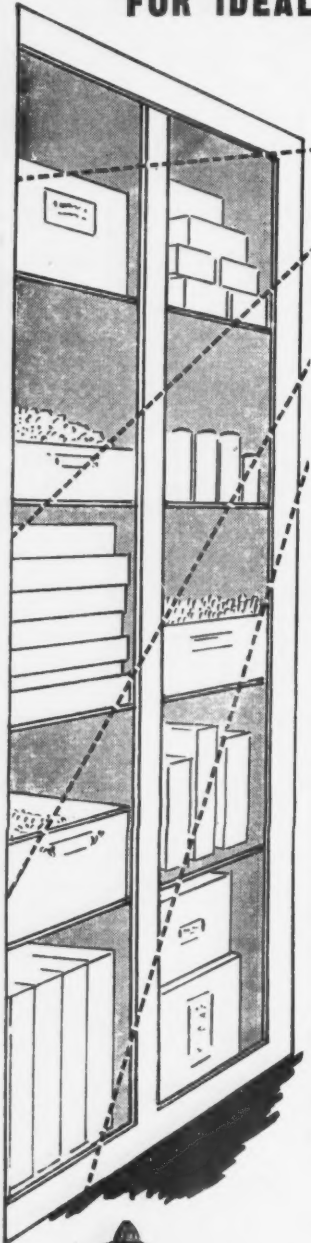


**Conduit  
Products**



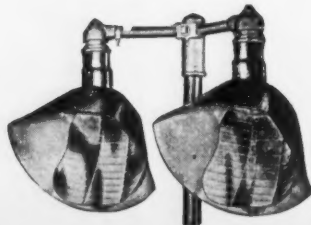
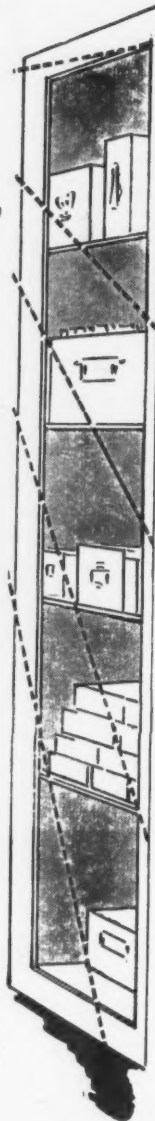
# QUAD

## AISLE STOCK REFLECTORS FOR IDEAL SHELVING ILLUMINATION



• This type of reflector fully meets the need of illuminating shelving, bins, or stacks of cartons piled on either side of narrow aisles. It does this important job because of its unique and practical design. Scientifically arranged reflecting surfaces make it possible for light to reach from upper tiers of shelving to floor level. There is effective eye shielding too. It is accomplished because of a lower light cutoff angle at each end of the reflector.

Suggest this reflector wherever you have a stock room lighting installation. Get all the details from us now!



### QUADRANGLE MFG. CO.

32 S. PEORIA ST.

CHICAGO 7, ILL.

## MEMO

Dear Mr. Contractor . . .

It is our pleasure to say welcome to you at our Booth No. 44 during the Third International Lighting Exposition.

Your visit will give us the opportunity to discuss your lighting sales situation, or we will gladly chat with you regarding your favorite football or baseball team. Then again you may want to tell us about that "75" you shot in golf last summer.

We are all for you for a better score in lighting sales. Maybe a little visit at our booth will give us both a lift. We are always happy to shake hands with our friends and to meet new friends—so come on over fellows and let's have a mixed business and pleasure session.

Sincerely

D. E. WORRELL  
GEO. ARRAS  
RAY GALLAHER



SEE US AT BOOTH 44



**I'm no  
contractor...  
but I  
planned  
my bathroom  
for *Comfort!***

Yes, this housewife and thousands of other homemakers like the *instant* heat provided by the FA Quikheter. They like its penny-pinching economy, too... for the FA Quikheter costs but a few pennies per hour of continuous operation.

In bathrooms, bedrooms or nurseries, the FA Quikheter lets them wash, dress, or shower in warm cozy comfort. A simple flip of the wall switch spurs the FA Quikheter into action... quickly and efficiently.

Plan to include the FA Quikheter in remodeling or new building plans. Homemakers will thank you for giving them instant and healthful heating comfort in rooms that need supplemental heat.

You'll find the low-cost FA Quikheter easy to install and economical on everything but comfort. Talk it over with your FA Representative, or write today for Bulletin No. 1102.



**Frank Adam Electric Co.**

ST. LOUIS 13, MISSOURI

**Makers of BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE  
EQUIPMENT • SAFETY SWITCHES • LOAD CENTERS • QUIKHETER**

# BIG NEWS!

Sylvania enters low-cost  
fixture field with

... **NEW**  
**ECONOMY MODEL**  
**EF-240**



**H**ERE's important news for electrical contractors—a Sylvania Industrial Fixture in the lower price bracket! For the first time, you can offer your customers a Sylvania fixture comparable price-wise to any in the low-cost fixture field! Here are some important features of the new EF-240 Economy Model:

It's finished in Miracoat—the durable baked plastic finish used on higher priced Sylvania models.

Standard knockouts for easy conduit mounting.

Die-punched deep-drawn chassis makes spacing of lampholders positive in assembly of fixture and totally encloses high-power-factor ballast.

Price includes two 40-watt lamps and Glostat starters.

Cut-off is adequate for many industrial and home workshop applications.

Completely wired—easy to assemble.

90-day guarantee of materials and workmanship.

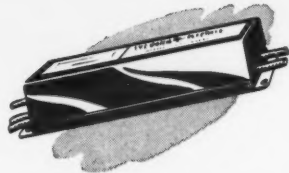
It's made by the makers of the famous HF-100.



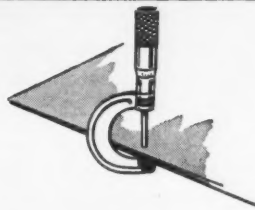
# LOOK AT THESE FEATURES



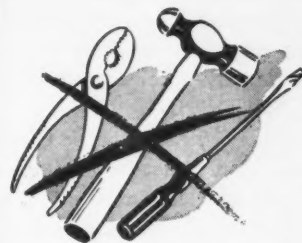
**Reflector Efficiency** is equal to, or better than, any comparable fixture on the market. Reflecting surface is Sylvania's exclusive Miracoat.



**High Power Factor Ballast**—85% or better! Ballast is totally enclosed in die-punched, deep-drawn steel chassis.



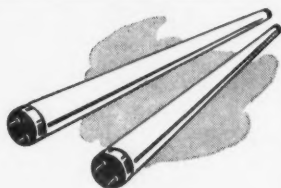
**20-Gauge Steel Through-out**—one piece chassis is deep drawn. Simple wing nut fastening of the reflector to the top housing.



**No Tools Required** for easy maintenance of this fixture.



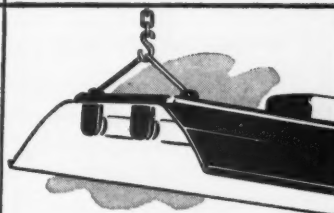
**Underwriters' Laboratories Approved**—The EF-240 carries the Underwriters' Laboratories seal of approval.



**Sylvania's Long-Life Lamps** are supplied—the finest fluorescent lamps money can buy. Longer life, more light than ever before.



**Glostarters** are standard equipment of the EF-240. These starters are Sylvania-made and give fast, reliable, long-lasting performance.



**Hanging Ears**, which are lanced-out, make it easy to attach unit to hanging device for regular industrial mounting.

Now is the time to get complete details of this revolutionary step in Sylvania's production. The EF-240 is a fine fluorescent fixture that will meet the requirements of a great many of your customers who desire a lower-priced unit. It is carefully designed to give dependable service. It has incorporated in it all the essential features expected in a fixture in

this price range—plus many exclusive Sylvania features such as the Miracoat finish and one-piece chassis.

Send us the coupon below for complete details about the EF-240. In addition, we will gladly put you on our mailing list for all future Sylvania developments of interest to you.

*mail coupon today!*

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FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; ELECTRIC LIGHT BULBS; PHOTOLAMPS; RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES

Sylvania Electric Products, Inc.  
Department L-6003  
500 Fifth Ave., New York 18, N. Y.

Gentlemen: Send me more information on the new EF-240.

You may place me on your mailing list for information on future fixture developments.

Name \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

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# G-E Q-Floor Wiring used in modern Cleveland Bank

When the Central National Bank of Cleveland opened its fourteenth branch office at 509 Euclid Avenue, it provided Cleveland with the most modern building and the finest banking facilities possible.

Complementing its modern design, this new structure has an electrical raceway system designed to maintain its modernity—Robertson Q-Floors with General Electric Q-Floor Wiring.

This General Electric Q-Floor Wiring installation is well-equipped to handle all immediate needs for electrical and signal service. In addition, provisions for future requirements are literally built into the permanent raceway system.

By means of simple fittings, the steel cells of the entire Q-Floor become part of the electrical and signal distribution systems. Since the cells are on six-inch centers, outlets can be installed every six inches in the floor.

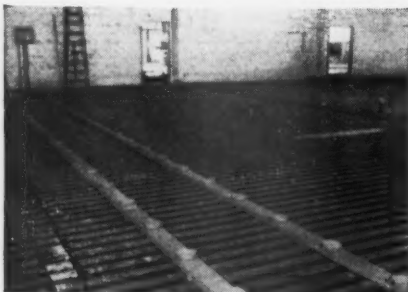
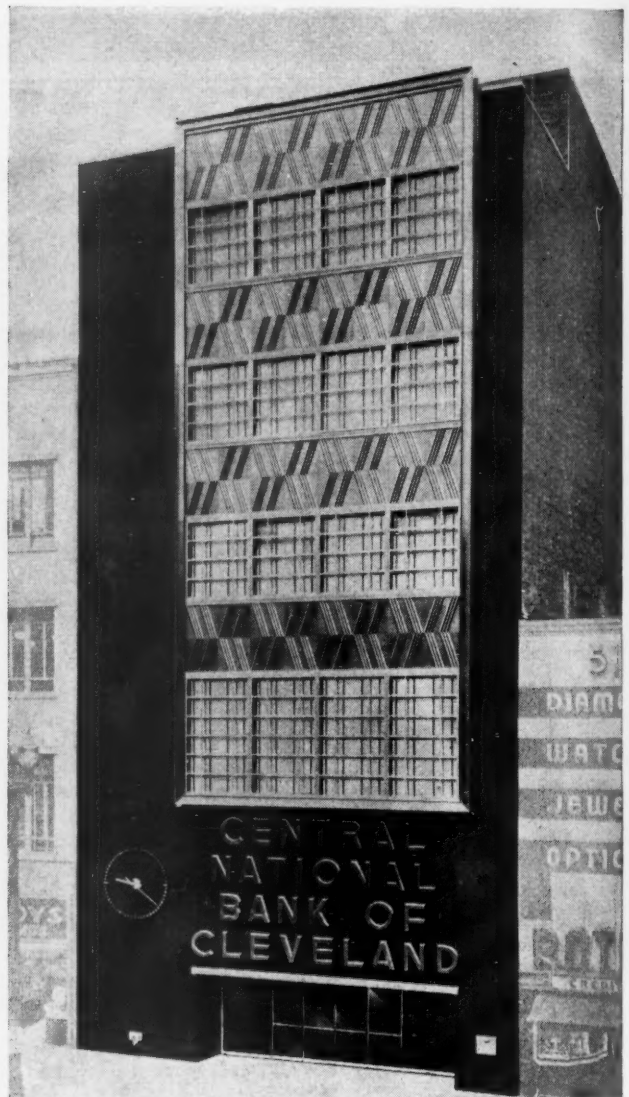
## Q-Floors suitable for any size, any type, of building

While Q-Floors are extremely suitable for monumental structures, any building—commercial, industrial, or institutional—can be designed to stay electrically adaptable with Q-Floor and G-E Q-Floor Wiring. In fact, there is almost no type of building where Q-Floor Wiring cannot be successfully employed.

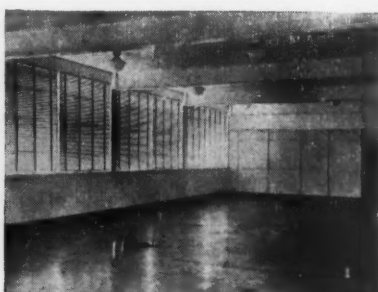
## Get complete details on G-E Q-Floor Wiring

The General Electric Q-Floor Wiring story is presented in a 106-page book, "Q-Floor Wiring Data Manual." This comprehensive catalog contains descriptions, wiring diagrams, installation details, and other valuable information on this highly-flexible distribution system for architects, builders, and electrical contractors. If you would like a free copy, write to Section C16-318, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.

*Q-Floor is manufactured only by the H. H. Robertson Company, Pittsburgh, Pa. Samples can be seen at any General Electric Construction Materials or Robertson district office.*



Q-Floor with electrical headers in place. To install an outlet anywhere in the floor, it is only necessary to tap through the floor surface to the Q-Floor cell, pull wires through, and install outlet.



View of a typical General Electric Q-Floor Wiring installation in an office, showing handy signal and electrical outlets before furniture is arranged.

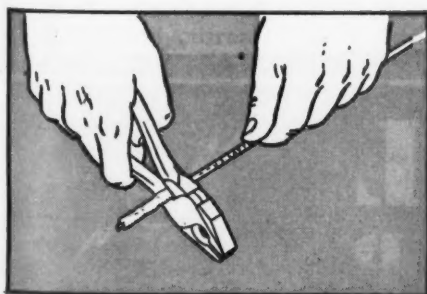
Architect: Conrad, Hays, Simpson, & Ruth  
 Electrical Engineer: Clyde H. Loughridge  
 Electrical Contractor: Martien Electric Company  
 General Contractor: The Hunkin-Conkey Construction Company  
 Manager of Building Department, Central National Bank of Cleveland: J. R. Behan

GENERAL  ELECTRIC

  
**Q-Floor Wiring**  
 FOR ELECTRICAL FLEXIBILITY

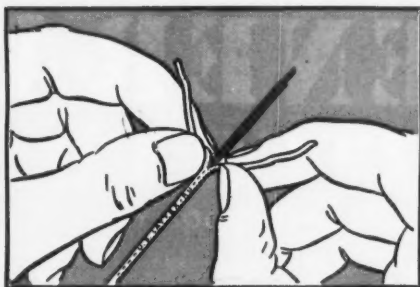


"It strips fast and easy  
...It's **Laytex RU**"



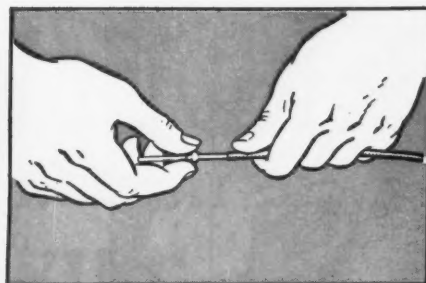
You don't need to use a knife when you strip Laytex RU. Just place the wire in the heel of side-cutter pliers—

and crush the cover for as far as you want to strip. This allows the saturated fibrous cotton cover—flame-

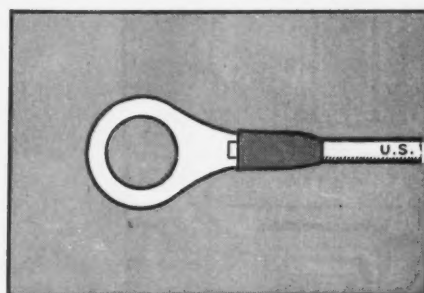


*All wiring with* **RU?**

retardant and moisture-resistant—to be quickly peeled back. The insulation is then easily rolled back . . . and you have a clean, quick strip.



There's no need to scrape with a knife—conductor is free of loose particles. Once you've made a connection, simply roll the insulation back over the barrel of the terminal and tape it up. You have a neat, streamlined job with *double* protection. In a laboratory test Laytex RU



was proved to be 33% to 300% easier to pull than 5 other leading brands. Most important of all, Laytex RU permits more wires per conduit on rewiring jobs because it is America's smallest diameter, lightest weight natural rubber insulated branch circuit wire. The dip process of applying the insulation guarantees perfect centering and no thin spots. Send today for sample plus booklet containing more details about this wire. Wire and Cable Department, United States Rubber Company, 1230 Avenue of the Americas, New York 20, N. Y.

\*Reg. U. S. Pat. Off



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**U.S. RUBBER**  
SERVING THROUGH SCIENCE

UNITED STATES  
RUBBER COMPANY



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General Switch Corporation are specialists in the design, engineering, and production of Enclosed Safety Switches, Service Entrance Equipment, Branch-Circuit or Residence Panels, Panelboards for Light and Power Distribution.

*Designed for*

- ★ GREATER CONVENIENCE
- ★ BETTER APPEARANCE
- ★ TROUBLE-FREE PERFORMANCE

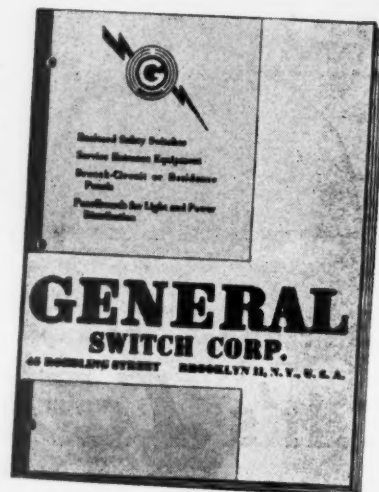
*Easy to install • Easy to service*

Send for the latest GENERAL catalog, complete with illustrations, specifications, mounting dimensions, selection tables, wiring data, knockout layouts, and a cross index of comparative catalog numbers.

Copies sent free on request.

*More and more Contractors and  
Wholesalers are switching to*

**GENERAL**



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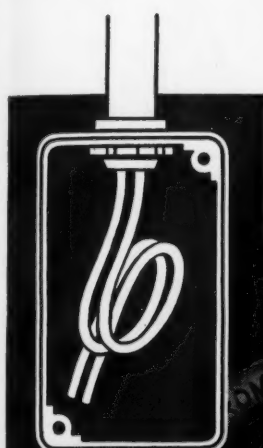
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# Rome

## SYNTHINOL\*

### THERMOPLASTIC INSULATED BUILDING WIRE



has these advantages

EASY  
PULLING

EASY  
STRIPPING

SMALL  
DIAMETER

FLAME  
RESISTANT

WATER  
RESISTANT

OIL  
RESISTANT

LONG LIFE

Underwriters' Approved

Rome Synthinol\* Building Wire will give you all these and many more advantages which add up to *lower-cost installation and long service life*. Here is a quality wire with smooth, anti-friction surface for *easy pulling*; uniformly small diameters for *more circuits per conduit*; and thermoplastic insulated for high resistance to oils, acids, moisture, and flame, all of which mean *safe and lasting service*. Bright, permanent colors provide quick and positive circuit identification.

Rome Synthinol\*—Type TW is fully approved under the National Electrical Code for installation in wet locations for 600 volt service. It replaces currently scarce and costly lead sheath. Smaller in diameter and lighter in weight, it is easier to handle and splice.

Try Rome Synthinol\* and discover for yourself its superiority.

For complete information write for Circular 101. It's yours for the asking.

FROM BAR TO FINISHED WIRE

**ROME CABLE**  
CORPORATION  
ROME • NEW YORK





## Freedom begins at home

IN America we take Freedom for granted. It is hard for us to understand why anybody would willingly give up his freedom, to live under a rule that dictates every move of his life.

Yet we must face the sobering fact that right here at home there are plenty of people who are working to curtail, and eventually to abolish personal

freedom, and substitute rigid central controls over our activities. Too often these misguided groups and individuals work harder at their self-appointed tasks than do we who think we prefer freedom.

We as business men, above all others, perhaps, have a responsibility in this matter which we can ignore only at the peril of our own survival.

### The Youngstown Sheet and Tube Company

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Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON, ALLOY AND YOLOY STEELS

ELECTROLYTIC TIN PLATE - COKE TIN PLATE - WIRE - COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - CONDUIT - RODS - SHEETS - PLATES - BARS - RAILROAD TRACK SPIKES.



Why I prefer  
to sell fixtures  
equipped with



# Certified Ballasts!

As a contractor, I hear the complaints when fixtures prove unsatisfactory.

I can't afford repeated customer gripes, so I handle only fixtures that are equipped with Certified Ballasts.

They assure me—

**Full lamp life**

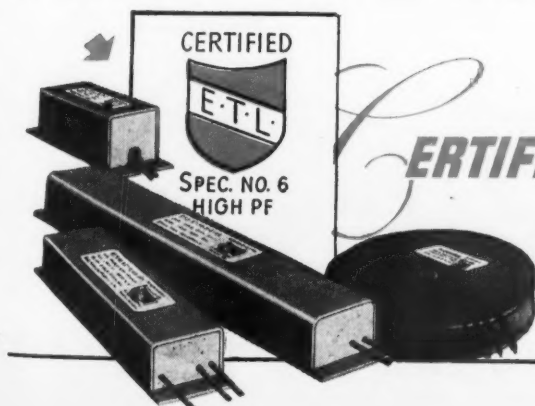
**Quiet operation**

**Rated light output**

**Reliable performance**

Certified Ballasts are made to rigid specifications—then tested and checked by impartial Electrical Testing Laboratories, Inc. That's why they're really reliable.

By insisting on Certified Ballasts I keep service worries to a minimum and keep my customers happy.

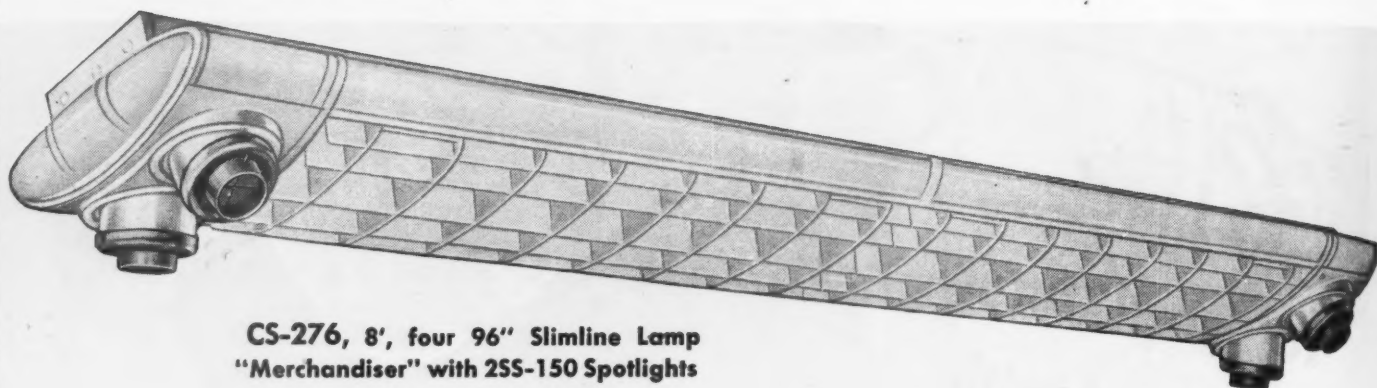


## CERTIFIED BALLAST MANUFACTURERS

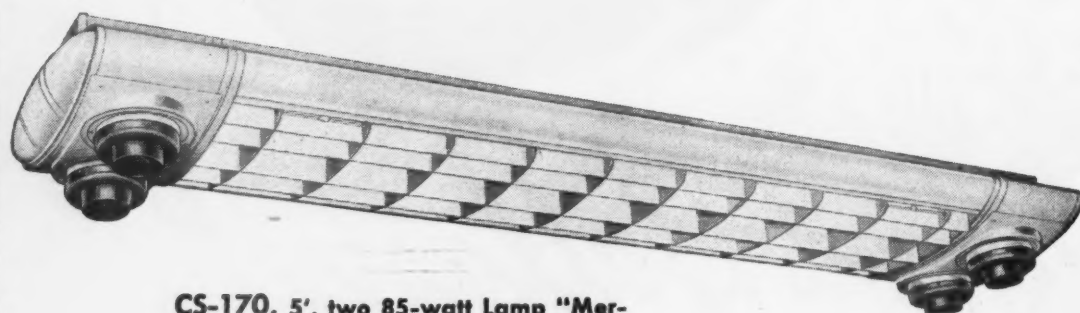
*Makers of Certified Ballasts for Fluorescent Lighting*

**2116 KEITH BLDG., CLEVELAND 15, OHIO**

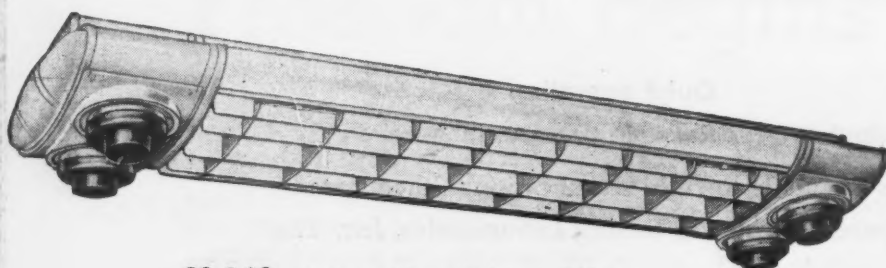
YOU CAN BE **SURE**.. IF IT'S  
**Westinghouse**



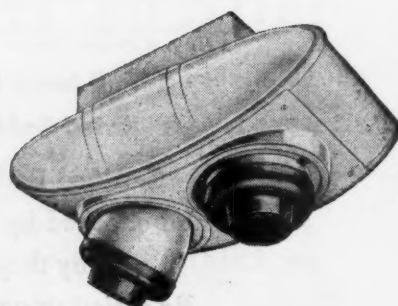
**CS-276, 8', four 96" Slimline Lamp**  
**"Merchandiser" with 2SS-150 Spotlights**



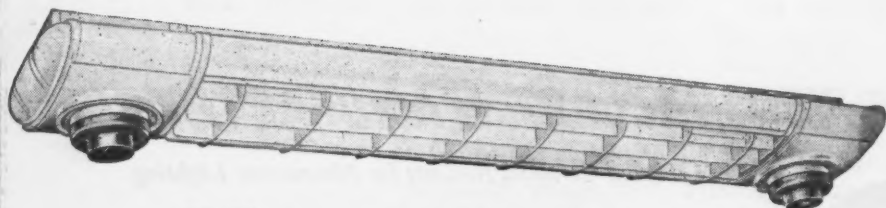
**CS-170, 5', two 85-watt Lamp "Mer-**  
**chandiser" with 2SS-150 Spotlights**



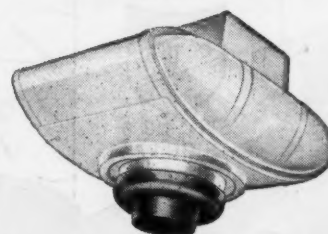
**CS-160, 4', four 40-watt Lamp "Mer-**  
**chandiser" with 2SS-150 Spotlights**



**2SS-150, for Two PAR-38 Spot or**  
**Flood Lamp**



**CS-80, 4', two 40-watt Lamp "Mer-**  
**chandiser" with SS-150 Spotlights**



**SS-150, for One PAR-38 Spot or Flood**  
**Lamp**

# THE MERCHANDISERS

... Standard Units That Provide

## "CUSTOM LIGHTING" FOR ANY STORE

**Flexibility of Installation**—The "Merchandisers" provide greatest flexibility to meet varying conditions. The different sizes and types are shown at left. Both the fluorescent and incandescent sections may be used individually, in groups, or in continuous rows. Spotlights may be combined with fluorescent sections in whatever arrangement is most suitable for your customers' needs. Swiveling feature permits both horizontal and vertical adjustments.

**Easy to Install and Maintain**—The lightweight housing may be quickly attached on the ceiling. Then it's an easy job to hang the ballast and reflector assembly in place. Cleaning, too, is simplified because there is little space for dust and dirt to accumulate. The louver may be easily removed for an occasional bath and lamps are readily accessible for replacement or cleaning simply by swinging down the louver from either side.

A Westinghouse Lighting Sales Engineer will gladly co-operate with you in planning lighting installations for your store customers. Call your local Westinghouse Distributor today.

J-04219

Free booklet B-4076 tells story of how to light store areas with the "Merchandiser". Send for it today. No obligation, of course. Write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.



**Westinghouse**  
**PLANNED LIGHTING**  
**PAYS**



# Large Utility Company Cuts Cable Installation Costs up to **50%**



**... and gets 10%  
greater current carrying capacity!**

For its recently built new boiler and turbine room, a well-known electric utility company chose to wire the installation with ROCKBESTOS A. V. C. spiral armored multi-conductor power cables.

Experience in its old plant had taught this company that the cost of installing interlocked armored cable is less than one-half that for cable in conduit.

Moreover, current carrying capacity of 3-conductor spiral armored cable is safely indicated to be 10% greater than three single conductors in conduit with normal occupancy.

Material, time and labor savings like these can be yours.

And they can be more dependably yours when you specify ROCKBESTOS A. V. C. — the original cable with the *permanent* insulation of impregnated felted asbestos.

Write.

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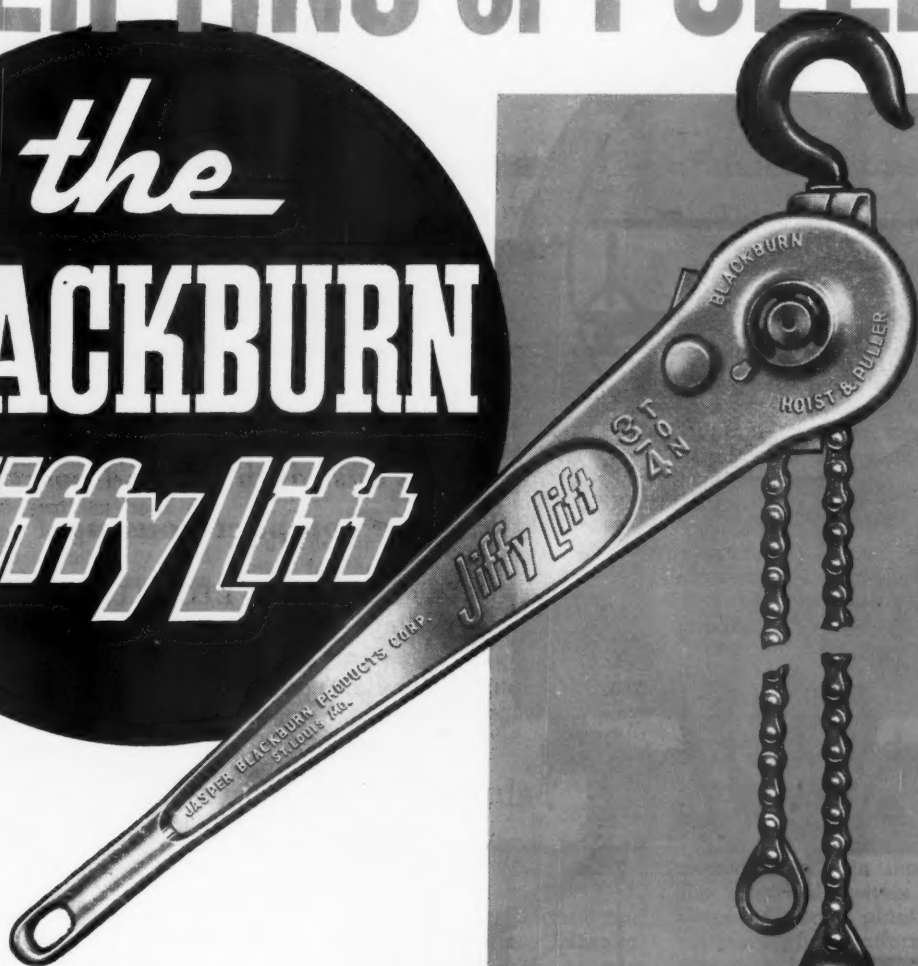


**WIRES and CABLES by  
ROCKBESTOS**

..... **dare to be better**

# HERE'S THE HANDIEST THING YET for LIFTING or PULLING!

## *the* **BLACKBURN** *Jiffy Lift*



**LIGHTEST!**

Complete hoist weighs less than 12 lbs., yet has  $\frac{3}{4}$  ton capacity, with large factor of safety.

**SIMPLEST!**

The only puller-hoist made with a single control for UP and DOWN and Automatic Free-Wheeling. Universal operation—handle operates on either side for lift or pull.

**FASTEST!**

Quick action, Ratchet-type. Easy to rig—quick to use. Operator can also vary lift per stroke. High efficiency means less fatigue.

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Tightening Guy Wires... Pulling Cables and Messenger Wires...  
Skidding or Lifting Heavy Equipment... Installing and Repairing  
Machinery... Pulling Motors, Wheels, etc... Lifting in Close Quarters  
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Send me, without obligation, Illustrated Circular describing the  
Blackburn Jiffy Lift Hoist & Puller, prices on same, and name of  
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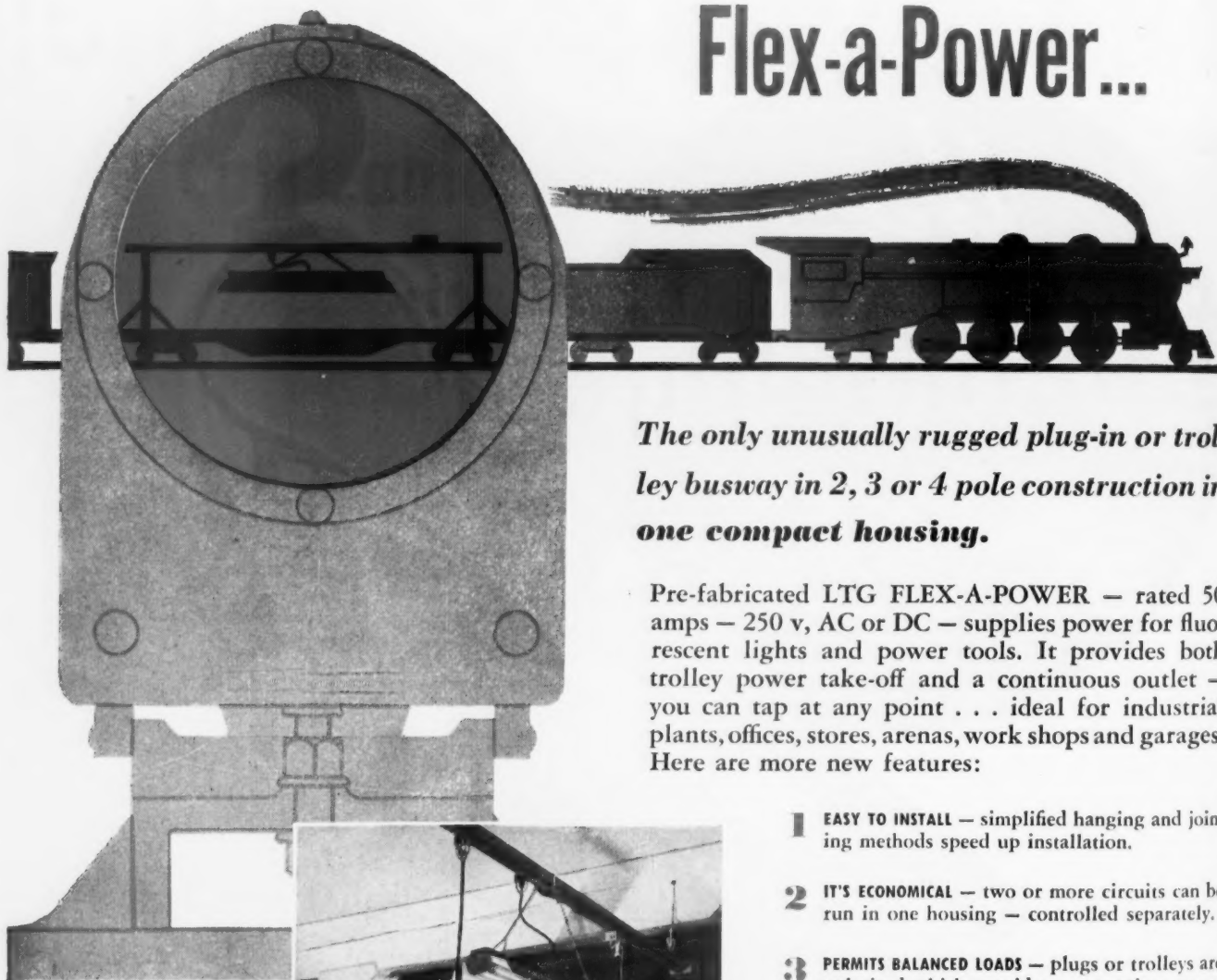
Your Name & Title \_\_\_\_\_

Firm Name \_\_\_\_\_

Address \_\_\_\_\_

ECM

# You get 6 big advantages with **New LTG** **Flex-a-Power...**

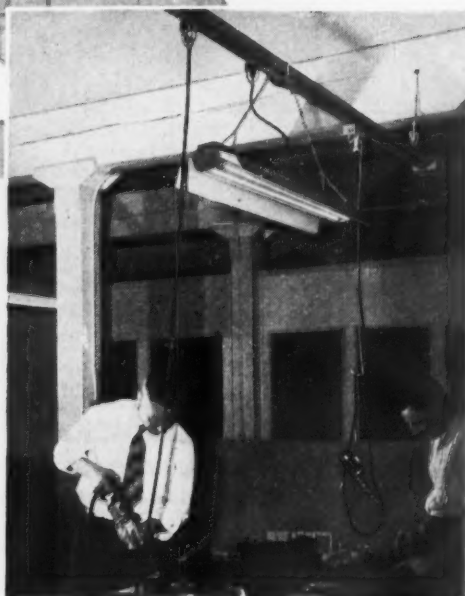


*The only unusually rugged plug-in or trolley busway in 2, 3 or 4 pole construction in one compact housing.*

Pre-fabricated LTG FLEX-A-POWER — rated 50 amps — 250 v, AC or DC — supplies power for fluorescent lights and power tools. It provides both trolley power take-off and a continuous outlet — you can tap at any point . . . ideal for industrial plants, offices, stores, arenas, work shops and garages. Here are more new features:

- 1 EASY TO INSTALL** — simplified hanging and joining methods speed up installation.
- 2 IT'S ECONOMICAL** — two or more circuits can be run in one housing — controlled separately.
- 3 PERMITS BALANCED LOADS** — plugs or trolleys are polarized which provides a convenient means of balancing loads.
- 4 IT'S REALLY RUGGED** — rigid construction of housing itself prevents sagging — only 2 hangers needed for each 10 ft. section.
- 5 MORE FLEXIBILITY** — standard fittings such as elbows and radius sections permit economical custom installations — easy to disassemble and relocate.
- 6 GREATER CONVENIENCE** — trolley with silver alloy contacts may be inserted or removed at any point along the run — no "drop-out" section required.

FOR MORE INFORMATION, write for circular TEC-3, THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn.



**Men Who Observe the Best Electrical Practice Make It a Practice to Use**

## TRUMBULL ELECTRIC

TRUMBULL'S TRAINLOAD OF NEW PRODUCTS



# MARCH . . . . at a Glance

## Lighting Maintenance

It is not by accident that this issue contains a special editorial feature section on lighting maintenance just as the Third International Lighting Exposition opens in Chicago. Months ago we sorted out from among the current problems and prospects in applied lighting several phases of the subject which would be most usefully complementary to the displays and discussions at the Exposition. We chose "Planned Lighting Maintenance." Maintenance considerations bear directly upon design, layout, application and use. The complexity and extent of modern lighting systems has substantially increased the weight that must be given to maintenance at every step in the work. Appearance, usefulness and plain economics are all critically affected. Fortunately, lighting system maintenance is subject to practical analysis. Operating conditions can be predicted and allowed for in design. Economical maintenance schedules can be developed from known characteristics of light sources, equipment and surroundings. Eastern Editor Berlon C. Cooper has brought these considerations together and developed them in a series of charts which we believe is a unique and exceptionally clear presentation of a difficult subject. A limited number of reprints are available at a nominal cost. And if you haven't yet obtained your tickets for

the Third International Lighting Exposition, use the handy coupon on page 149. Your tickets will be on the way by return mail.

## Radio Power

What with the growing interest of electrical contractors in the electrical construction market represented by modern radio, television and relay plants, we studied a report from our London office with unusual interest, because it concerned features of B.B.C.'s 1500 kw. transmitter at Skelton. The wiring and electrical equipment for that kind of power is necessarily substantial. Provision for multiple sources and dual distribution add further complexity. We think you will find the report as interesting and informative as we did. It's titled, "Long Range Power" and begins on page 68.

## Hospital Signals

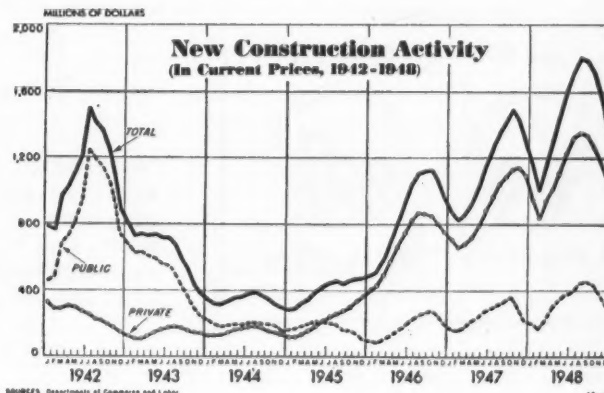
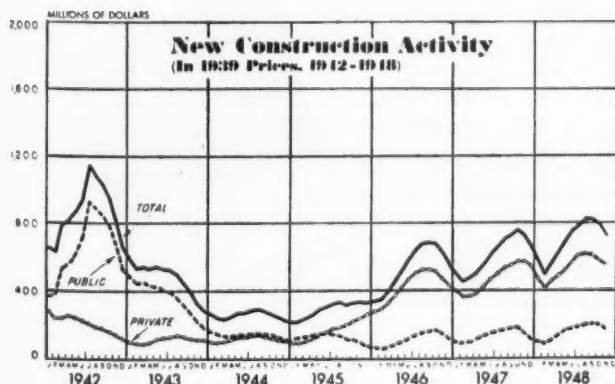
The long range hospital building program now current gives special timeliness to A. A. Schuhler's current article in his series on signal and communication systems, "Hospital Signal Layouts" on page 70. It covers layout, wiring and power consideration for these often complex installations. Incidentally, Schuhler's series of articles has stimulated wide interest.

## Enclosed Bus Systems

When enclosed bus distribution systems grew so rapidly under the extraordinary conditions of war production, we often heard the caution that come postwar and less hectic operations, the popularity of such methods of distribution would decline. Today, however, we find bus duct systems are most lively contenders for the favor of electrical men in solving not fewer, but many more varieties of power distribution problems. Considerations of bus system engineering layout and application are an essential part of industrial electrification know-how. To help, R. W. Blatchford of BullDog begins a comprehensive series on bus duct distribution in this issue on page 113.

## System Modernization

Distribution flexibility and provisions for plant changes at low operating and maintenance costs were top considerations in the revamping of the electrical system at Liquid Carbonic's Chicago plant. Power centers on mezzanine platforms at load centers plus lateral secondary distribution to column head terminal boxes provides short runs and convenient access. "Lateral Distribution Flexibility" by R. B. Burton on page 59 gives the details.



Anaconda continues its "Wire Ahead" Campaign to your industrial customers. They are reading this ad now.

How Big is the CORE



of your POWER apple?

Densheath Type TW Building Wire with its special thermoplastic insulation is sound production insurance in any plant. It will not support combustion, is long-aging, impervious to acids, oils and alkalis. It is recognized by the National Electrical Code for circuits up to 600 volts and temperatures up to 140° F....and for wet and oily locations. Being light weight, with a smooth, slick finish and without braid, Densheath pulls through easier...resists abrasion. Permanent, bright colors for quick circuit identification. Write for literature.

This is important, too—for rewiring in existing raceways, the Code recognizes the smaller diameter of Densheath TW and permits more conductors to be pulled in the same size conduit. Here is a typical case—

#### ½" CONDUIT

##### Type R



3 #10 Wires

##### Type TW



6 #10 Wires

How MUCH of the electric power you pay for do you *throw over your shoulder* through overloaded, overextended, obsolete, inadequate wiring?\*

Avoid wasting power. Find present losses and safeguard future expansion. Talk to your plant power engineer, consulting engineer, electrical contractor, wholesaler or utility power salesman. It's their job to advise and protect you against slow-downs and shut-downs that mean unproductive wages, lost production, spoilage.

40-120A

\***WIRE AHEAD**... a comprehensive discussion of preventive maintenance, points out the symptoms of inadequate wiring, presents detailed plans for anticipating electrical demand. Forty-eight factual pages of practical information and suggestions free on request.



**ANACONDA WIRE & CABLE COMPANY**

25 Broadway, New York 4, N. Y.

# LIGHTING OUTLOOK

THE LIGHTING EXPOSITION is a meeting of compelling industry interest. It provides a rallying point and a forum for all the industry. It provides inspiration, guidance and a chance to orient different points of view to common objectives. In lighting, these are of the utmost importance today, particularly to electrical contractors.

MANUFACTURERS WILL DISPLAY the newest in luminaire design, the best in auxiliaries, the last word in light sources during the closing week of this month in Chicago. Leaders from all branches of the industry will direct a program of conferences to explore current knowledge and future prospects in lighting. Winners in a nationwide lighting competition will be announced and their work displayed to inspire more planned lighting.

LIGHTING APPLICATION is moving at an extraordinarily rapid pace. Fluorescent lamps are only a little over ten years old. As a light source, however, they are already dominant in new commercial and industrial lighting, and, logically enough, fluorescent lighting systems have sparked many ingenious and useful new applications of incandescent lighting. Further, the current trends in planned lighting require us to consider several light sources, a variety of equipment and even the furniture and surrounds. To keep abreast, we are compelled to know and understand an ever widening array of equipments, materials and methods.

THROUGH PLANNED LIGHTING design, engineering sales, application and maintenance there are complex lines of industry policy and practice. Manufacturers, utilities, wholesalers, contractors are all engaged in lighting progress. Their individual interests are often different. But planned lighting has created a marketing approach, within which we can mobilize the full potential of the electrical industry, well able to give force and unity to lighting sales. The lighting conference is a useful rallying point.

LABORATORY SCIENTISTS, design engineers and manufacturing genius have brought forth a wealth of new lighting tools and techniques. Some will be shown for the first time. The outlook in applied lighting will be determined, however, by what those who lay out and install lighting systems do with the equipment as it becomes available. The electrical contractor is destined to carry an ever larger share of the responsibility for lighting progress in the years ahead.

*Wm. D. Stuart*





# FRESH AIR

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# Lateral Distribution Flexibility

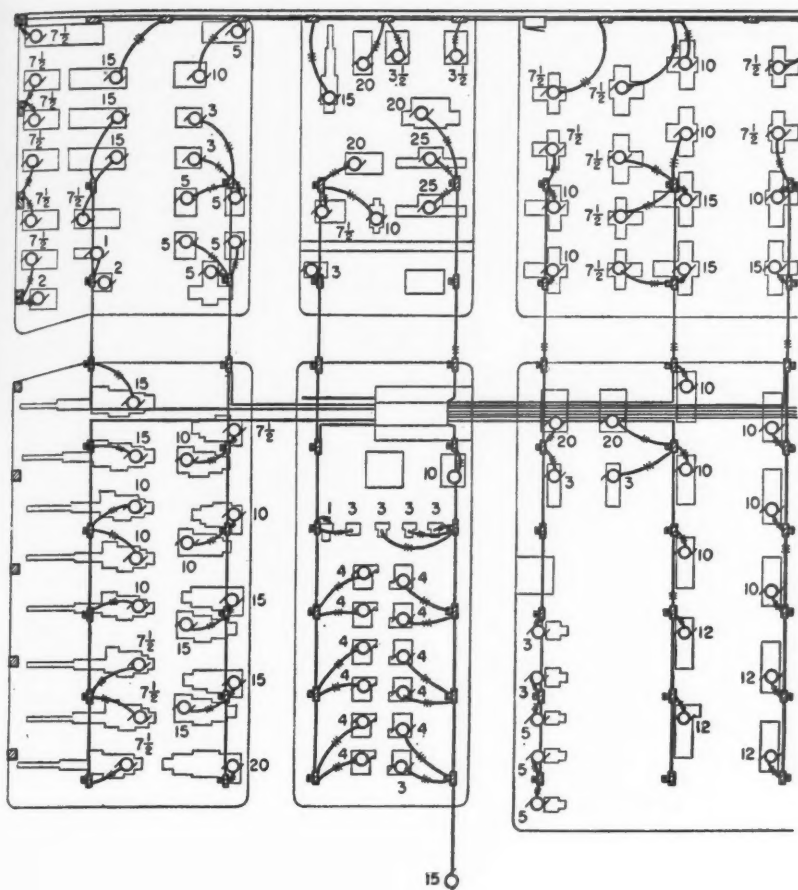


FIG. 1—Plan of lateral distribution system. Separate circuits feed rows of building columns. Branch circuits are connected to feeder at head terminal box on each column.

By **Robert B. Burton**

Supervisor, Electrical Maintenance and Construction  
The Liquid Carbonic Corp., Chicago, Illinois.

**R**EVAMPING of the electrical system was part of a complete modernization program at the Chicago plant of The Liquid Carbonic Corporation. In redesigning the system, careful consideration was given to branch circuit distribution flexibility and the possibility of future changes in production department layouts. Both factors have an important bearing on plant operating and maintenance costs. Major objective was the reduction of these costs to a practicable minimum.

The old system involved long secondary feeders from two main distri-

bution points with the inherent voltage drop losses and expensive wiring changes when machines were shifted. Under the new plan, several 220-volt, 3-phase, secondary power centers are located on mezzanine platforms at points of load concentration. They are served by transformer vaults fed by 4,000-volt underground feeders originating at a 12,000/4,000-volt main substation served by dual power company circuits.

Secondary distribution is of the lateral type with feeders originating at the load centers and extending throughout the plant areas to serve groups of

Feeder terminal boxes at each column provide branch circuit distribution flexibility at The Liquid Carbonic Corporation's Chicago plant. Design minimizes maintenance and permits quick shift of department layouts.

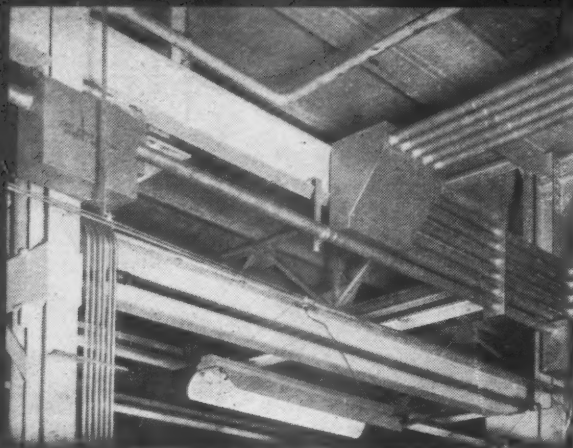
machines. Conduit raceways with single-conductor insulated cables were found to be best suited to the structural features and production processes throughout the plant. In general, feeders consists of 2½-inch and 3-inch conduits with 4/0 and 500MCM cables (3-phase, 3-wire). On the basis of a predetermined diversity factor of 58 percent, these feeders can handle loads of 90 and 160 horsepower respectively. Separate circuits feed each row of plant columns and are protected by fused disconnect switches at the power centers.

## Terminal Box Access

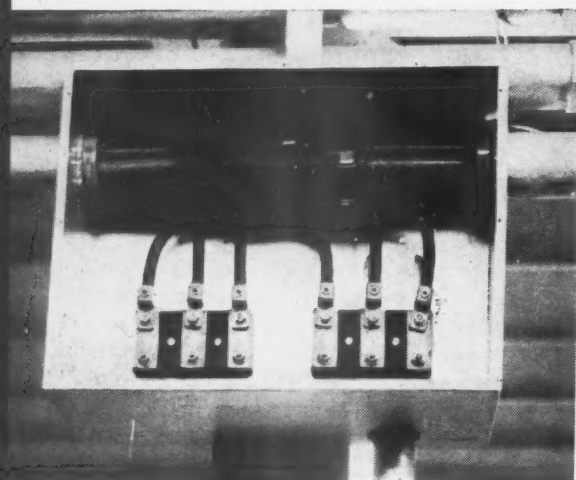
Power sub-distribution panels have, in most cases, been eliminated by this design. Individual motor circuits can be connected direct to the lateral feeders at each column in the plant; can be quickly disconnected in case a machine is shifted. Such branch circuit flexibility is possible through the installation of head terminal boxes at the head of each column. Inserted in the lateral feeder run, these boxes contain two terminal blocks connected to the feeder conductors by short U-shaped cable jumpers and insulated, solderless, parallel cable taps. Each terminal box provides tap-off facilities for 50 horsepower of connected load.

Present practice is to feed one, two or three motors from each header box. Conduit and cable drops of one-third feeder capacity terminate in a fused disconnect switch on the column (well within the 20-ft Code rule). One switch is used for each motor served.

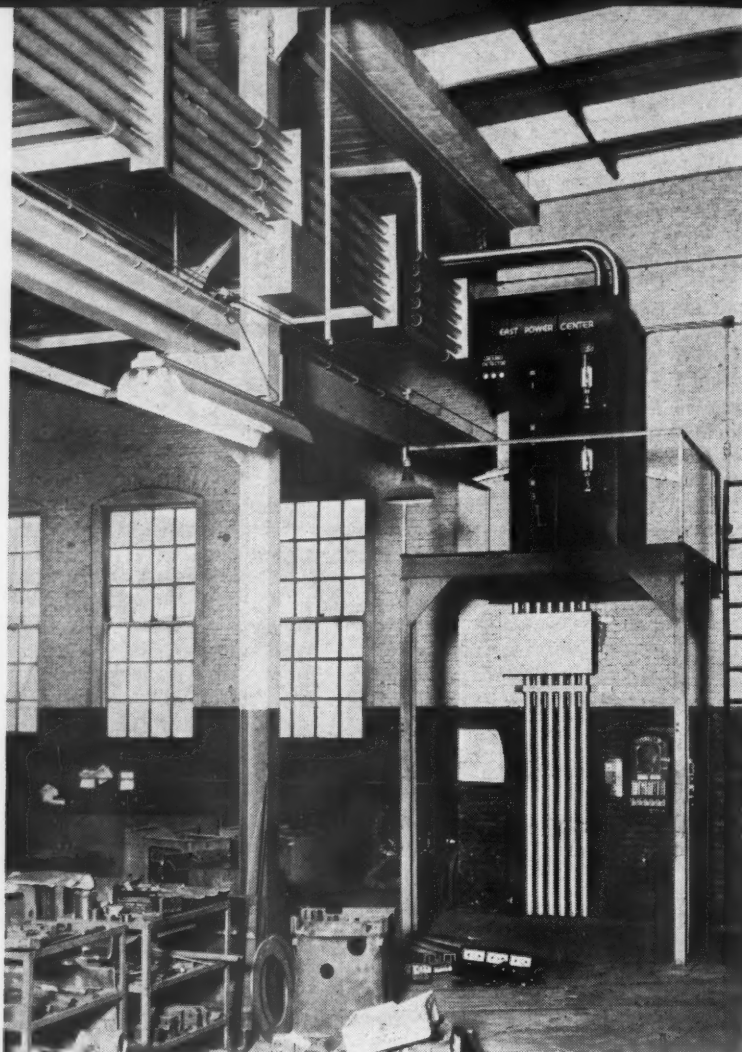




**LATERAL FEEDER CONDUITS** racked on building steel with cross-over pull box for direction change.



**INTERIOR OF TERMINAL** box at head of column showing connection blocks for power taps.



**SMALL LOAD CENTER** feeds portion of lateral distribution system. Mezzanine mounting conserves floor space and protects equipment.

Small sub-distribution power panels are used only when a considerable number of small motors are located in the vicinity of a column.

Should a machine be shifted to another location, the column switch and conduit drop is disconnected from the head terminal box and re-installed on the column nearest the new machine location. Formerly, wiring all the way back to the distribution panel had to be torn out. Considerable economy of change-over time and material salvage are among the tangible benefits of the new system design.

No production time was lost during electrical system modernization. The new lateral feeders were installed and fed temporarily from the old distribution boards. Machines were connected to the panel terminal boxes. As the new power centers were completed, permanent connections were made to the laterals.

The same lateral distribution scheme with column head terminal boxes, was used in the newly constructed plant addition where soda fountains are

built. Here, the use of Pyranol filled transformers eliminated the need for vaults; permitted installation of transformers and distribution board as an integral unit on the main production floor. A wire mesh screen provides the substation enclosure, permits natural ventilation of the equipment.

One half of each of two distribution boards serves the power system (220-v, 3-phase, 3-wire); is fed by a 500 kva., 4,000/220-volt, 3-phase transformer. The other half serves the lighting system and is fed by a 300 kva., 3-phase 4,000/120/208-volt transformer mounted directly behind the board with a short secondary enclosed bus connection. Primary disconnects are behind the transformers in the same enclosure.

A considerable number of portable electric tools are used in the new plant for grinding, polishing, buffing and similar production operations. These are mounted to and fed by long runs of power trolley duct which supplement the lateral power distribution system.

Trolley duct, compressed air lines

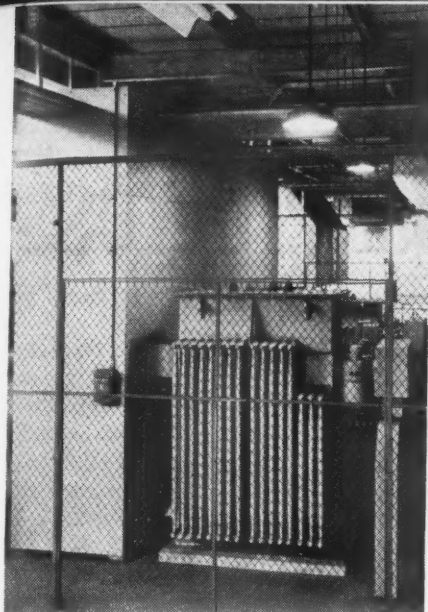
and continuous row fluorescent lighting are all suspended from messenger cables that span the width and length of the assembly area. Lateral conduit feeders for stationary machines are mounted to the building steel.

Electricians have no difficulty in tracing circuits at the Liquid Carbonic plant. All electrical conduits, pull boxes, load centers, disconnect switches, motors, and other equipment, are painted a light blue color. Load centers are plainly labeled as to location and function; have special lighting troughs to illuminate the front of the board. On the face of every head terminal box at each column is stencilled the power center that serves it and the circuit number of that specific feeder.

All disconnect switches on power branch circuits are clearly identified with the machines they control.

The electrical systems in both of these plants have been designed with an eye to simplified maintenance, and efficient and economical operation—all of which contribute to lower unit production costs.

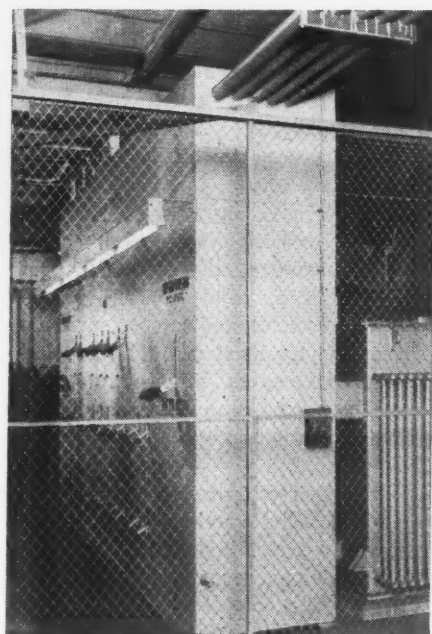




**DUAL UNIT SUBSTATION** in new plant addition. Transformer in foreground is power; that in background lighting.



**GENERAL ASSEMBLY** area in new soda fountain plant has 48 footcandles of illumination from continuous rows of fluorescent units on messenger cables. Trolley duct for portable electric tools supplements lateral power distribution.



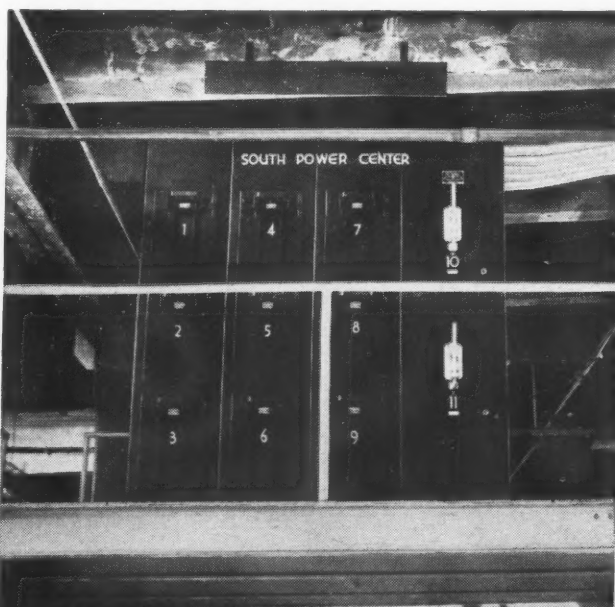
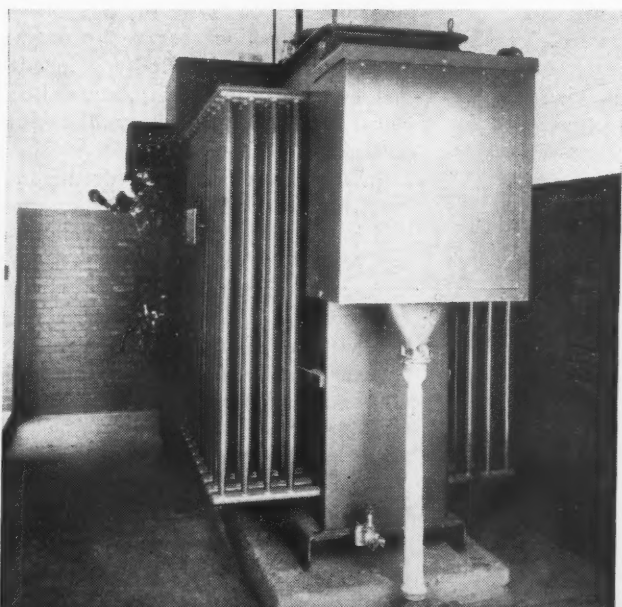
**FRONT VIEW OF** unit substation combined light and power load center. Note special lighting trough.



**MESSENGER CABLE** network with V suspension brackets support drop-cord test outlets in cooler box test department. Each outlet has fuse, pilot light and control switch.

**TRANSFORMER VAULT** with a 750 kva., 4,000/220-volt, 3-phase unit and secondary breakers to serve two power centers.

**LARGE POWER CENTER** on mezzanine platform in center of plant area. Note large identifying numbers on feeder switches.



# Framework For Electronic Progress

Prominent manufacturing plant and all-metal laboratory center, dedicated to the development of radio, television, radar, telephone and telegraph, is dependent upon modern electrical methods, materials and services.

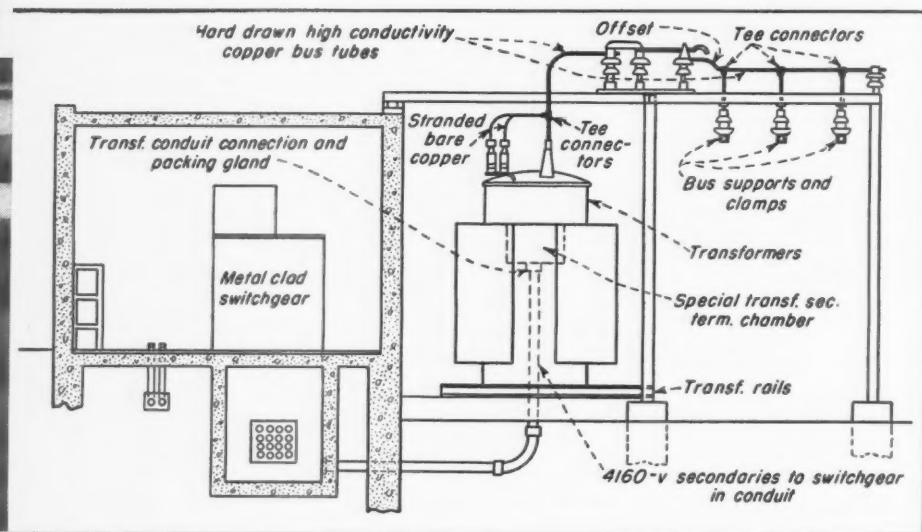


FIG. 1—MAIN SUBSTATION combines outdoor 26.4-kv/4160-v oil-insulated transformers with indoor metal-clad switchgear. Cable connections between primary transformers and switchgear are carried through underground conduit runs and walk-through cable vault.

TWO affiliates of the International Telephone and Telegraph Company—Federal Telephone and Radio Corporation, and Federal Telecommunication Laboratories—have created a new landmark for northern New Jersey. For, now rising from pre-war golf fairways straddling the Nutley-Clifton township line, a glistening aluminum-walled 300-foot tower signalizes the completion of the world's newest and largest all-metal commercial group.

Within and beneath this modern microwave tower, startling new communication techniques are being developed. Simultaneous transmission of improved television, pulse time modulation telephony, two-color radar, improved automobile radio-telephones, and almost unlimited new channels for telephone, telegraph, radio and television transmission are coming into practical being. From the revolving antenna atop the narrow tubular stem of the tower, down to switchgear beneath the surrounding laboratory struc-

tures, emphasis is exclusively on commercial and military communication research.

While research is stressed in this tower-dominated group, manufacturing is carried out in a separate development lying a stone's throw to the north. This manufacturing group not only includes facilities for the manufacturing of telephone and radio equipment, high frequency radio cable, vacuum tubes and selenium rectifiers, but also provides space requirements for administration, sales shipping, display, storage, repairs, and apparatus for plant heating and electrical transformation.

Due to the size and nature of this combined development, various architect-contractor teams were employed to speed the construction of the several laboratory and manufacturing structures; erection of the various buildings then proceeding independently. Sharing credits for the completed project, therefore, are Architects—Louis S. Weeks; Giffels and Vallet, Inc., and

By Hugh P. Scott

L. Rosetti, Associated Engineers and Architects; Building Contractors—The Turner Construction Company and the George A. Fuller Company; and Electrical Contractors—the Lord Electric Company; Watson-Flagg Engineering Company; and Naumer Electric Company.

In scope, the electrical contract for the manufacturing area included the furnishing and installing of underground distribution ducts, manhole and trench hardware, all wire and cable, busduct, power and lighting panels, lighting fixtures and lamps, sprinkler alarms, motor starters, unit and electric space heaters, pumps, and complete electrical equipment for control centers, ventilation system, garage and boiler house.

Utility service, received overhead at 26.4-kv., 3-phase, 60-cycles, is transformed to a primary distribution level of 4160-volts at a main substation that links outdoor transformers to indoor switchgear. Transformers, oil insulated, have self-cooled capacities of 4-, 5-, and 6000-kva. with forced-air ratings of 6-, 7-, and 8000-kva. They are equipped with three full capacity taps in the high voltage windings, position indicators, and grounding pads on the high-tension side of the tanks proper. Connections between primary transformers and the 4160-volt metal-clad switchgear in the adjacent switch house are underground, with cables carried in 4-inch conduits.

Switchgear consists of 15 dead-front metal-clad vertical-lift cubicles assembled in a continuous row and containing power busses, instrument transformers, oil circuit breakers, secondary wiring and a tie breaker between the two sections of a split 4160-volt bus structure. All cubicles are equipped with interlocks, so arranged that removable elements cannot be shifted to operating positions while breakers are



closed, oil circuit breakers cannot be closed while removable elements are withdrawn. Barriers of steel between compartments are removable to permit free access to all equipment.

Switchgear is positioned directly over a reinforced-concrete walk-through cable vault which extends the length of the entire substation structure and connects at either end with underground duct runs. Duct runs, extending from the main switching and control center to local sub-stations in the development's various structures, consist of multiple 4-inch fiber conduits which are concrete-sheathed and buried below normal frost levels. Conduits carrying power cables are grouped separately from those containing lines for signaling, control and telephones, although the two lines of ducts are located adjacently parallel in the ground and utilize the same duplex service manholes. High and low tension cables are also confined to separate areas within the manholes proper by means of reinforced-concrete division walls,

while access to these twin areas is through separate ground-flush cast-iron frames and covers. In all, underground distribution ducts serve one 500-, two 750-, five 1000-, and one 2550-kva. 3-phase 4-wire 4160-120/208-volt indoor dry-type transformer substations in the manufacturing plant; one outdoor 500-kva. unit located adjacent to the boiler house; a 10-kva. single-phase 4160-115/230 volt assembly supplying current to OCB heaters, battery chargers, blast fans and yard lights and three units, respectively rated at 500-, 300- and 200-kva., located in the laboratory group.

In the 14-acre manufacturing plant, the six indoor load centers are based along the 1000-foot northern basement wall at approximate 180-foot intervals. Free-standing, metal-clad and dead-front, these air-cooled assemblies house transformers, disconnect switches and all necessary switchgear. From these load centers, installations of low-resistance feeder-busduct (Fig. 3) extend to tap boxes and non-fusible busbar

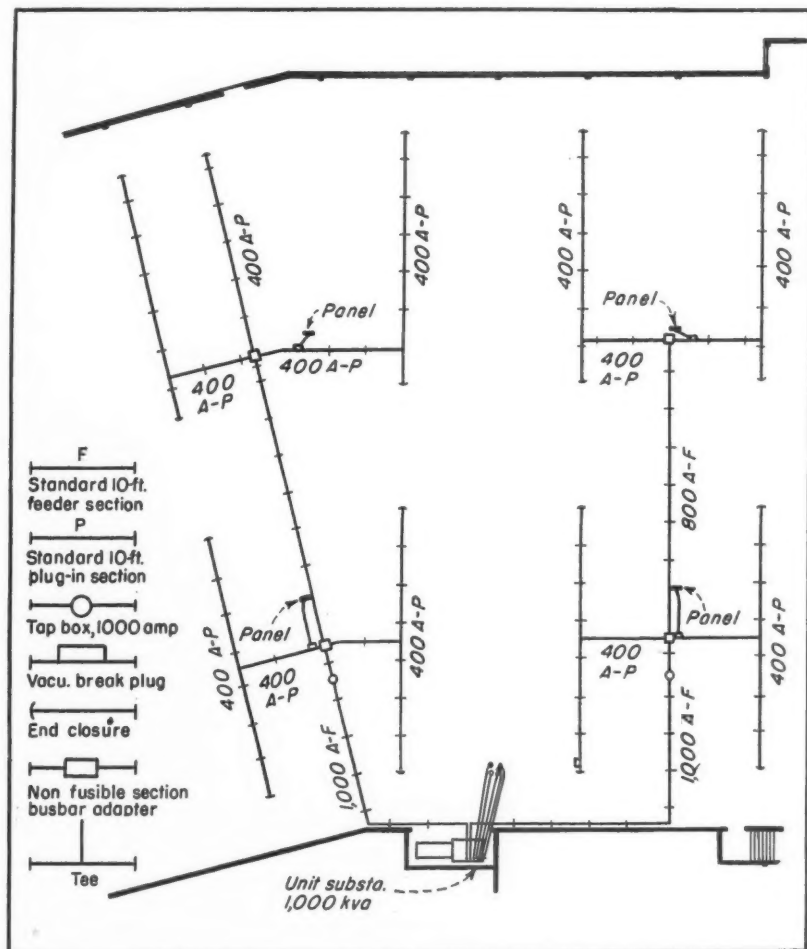


FIG. 3—BUSDUCT DISTRIBUTION required many specially-designed sections due to architectural plan of the manufacturing plant. To speed the installation, accurately-measured wooden

spacers were installed in place of these special units and were replaced as special sections arrived on the job. The precision fit was a tribute to manufacturing and installation accuracy.

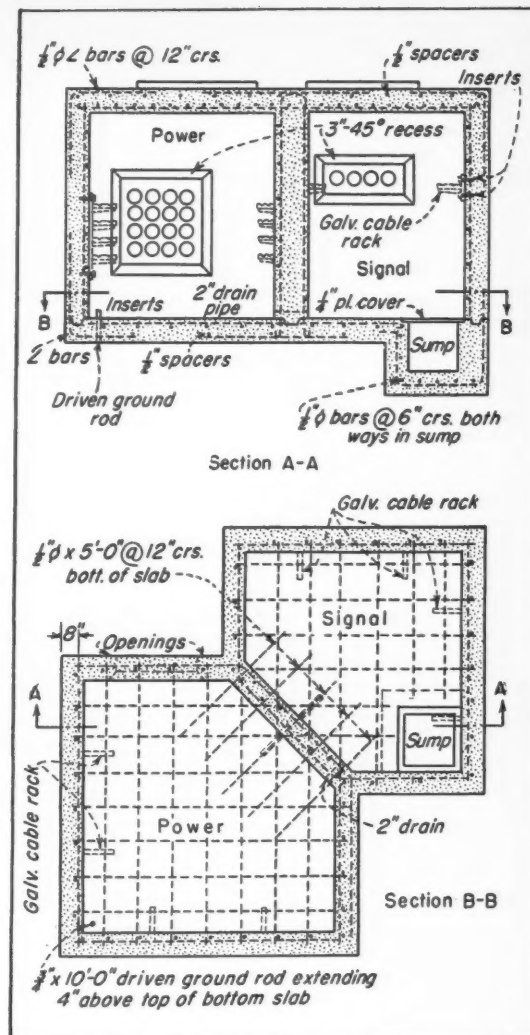
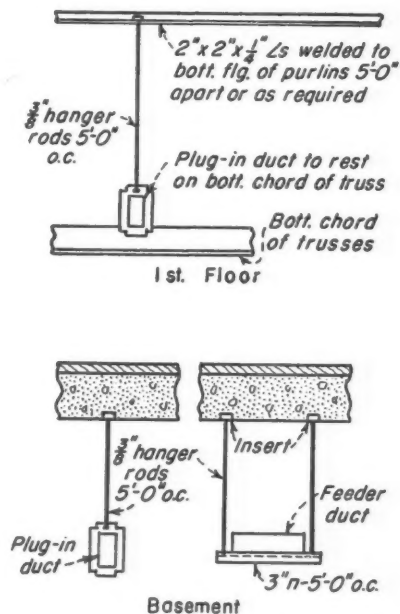
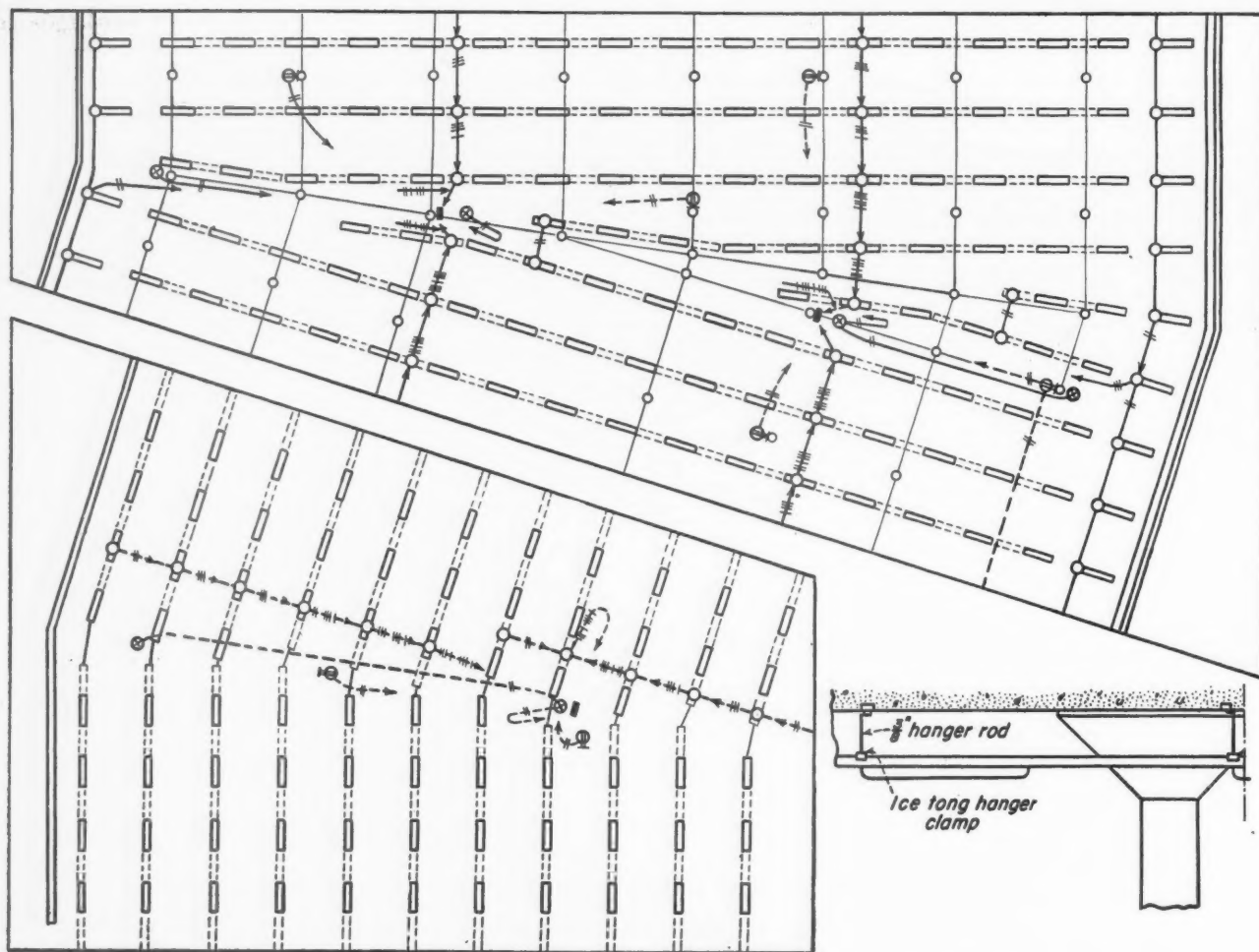


FIG. 2—DUPLEX MANHOLES keep power and signaling cables segregated by means of a reinforced concrete division wall. Use of twin manholes resulted in construction savings and localized service and inspection centers for both high- and low-tension distribution systems.







**FIG. 4—FLUORESCENT FIXTURES**, used for general illumination throughout the manufacturing areas, are mounted on continuous troughs and positioned two units apart, thus providing for future addition of fixtures without the necessity of major

revisions. Depending upon utilization of space, fixtures are suspended either parallel or perpendicular to exterior walls, resulting in a changing suspension pattern at the junction of the plant's various structural segments.

adapters connecting with the plant-wide overhead plug-in busduct framework. Elevator motors, fan housings and floor ducts are separately served by cable.

The assembly of the busduct forcefully demonstrated the importance of precision in engineering, manufacture and installation. For, due to the architectural design of the plant whereby the manufacturing structure takes the form of a shallow three-segment crescent, changes in busduct direction were at other than 90-degree angles. So, although standard busduct sections, tees, elbows and crosses could be used generally, special sections were necessary at many junction points in the plant. (Fig. 3).

Since standard forms were delivered to the job considerably in advance of special forms; since construction schedules had to be met, and since trained construction men were already on the job, the busduct installation was started before the special sections were

received. Carefully measured wooden spacer blocks were inserted where special forms were required. In this manner, the 3½-miles of BullDog plug-in and Lo-X duct rapidly took shape and, as special sections arrived, they were substituted for the wooden spacers. In every case, the substitution resulted in a precision fit; a tribute to manufacturing and to the practical on-the-job know-how of the Lord Electric organization and of BullDog's field engineers D. H. Jones and M. C. Nelson. Above the main floor, all busduct is installed above the lower chords of roof trusses, with intermediate supports welded to the bottom flanges of roof purlins. In the basement area, feeder and plug-in duct is suspended by hanger rods on 5-foot centers inset into main floorslabs.

Also contained in floorslabs are conduit runs which carry power from busduct adapters to permanent fans, blowers, motors and narrow-column type panels for both power and light control.

Lighting panels are of the circuit breaker type, with remote control switches electrically operated and mechanically held. Remote control switches are also activated by 2-button pushbutton stations. Power panels are of the Saf-to-Fuse removable head type with fusible switch branches.

Both fluorescent and incandescent illumination is utilized throughout the plant; fluorescent fixtures generally being used in manufacturing, administrative, clerical and display areas, and incandescent illumination being used in storage, loading, vapor-filled and out-door locations.

Fluorescent fixtures generally contain low-brightness 100-watt 5-foot lamps, with protective wire guards holding the lamps when vibration is present. In the manufacturing areas, open-end porcelain-enameled RLM reflectors are mounted on continuous troughs, and are positioned on 10-foot centers along these troughs. Wiring

(Continued on page 193)

# Universal Armature Data

By L. M. Konstam

**T**AKING winding data of universal type armatures, such as used in portable electric tools, presents a problem of its own. In rewinding a d-c armature a slight change in lead swing will have a negligible effect and a reversal of motor rotation can easily be corrected even after the motor is assembled. On the other hand, where universal motors are involved, similar changes may prove troublesome, as brush leads are often inaccessible for reversal and even a smallest variation in lead swing may result in poor commutation and cause excessive sparking. Also it is often desirable to rewind an armature exactly as original. The type of baking varnish used on most armatures makes the problem of obtaining exact winding data in the usual manner, most difficult and time-consuming. However, by following method described below the necessary data can be easily secured.

When rewinding armatures the following information is required:

1. Sequence of coils (to right or left).
2. Direction of winding (clockwise or counter-clockwise).
3. Position of leads (at right or left side of coils).
4. Span of coils.
5. Lead swing, from slots to commutator.
6. Number of turns.
7. Size of wire.

Of the above, the last two items are obtained in the usual manner by stripping the armature. Items 1 and 4 are determined by inspection. To secure the other data two tests must be made.

**TEST 1** Test leads from 120 volt supply (through a lamp) are applied to two adjacent commutator segments, as shown in Fig. 1. A thin strip of

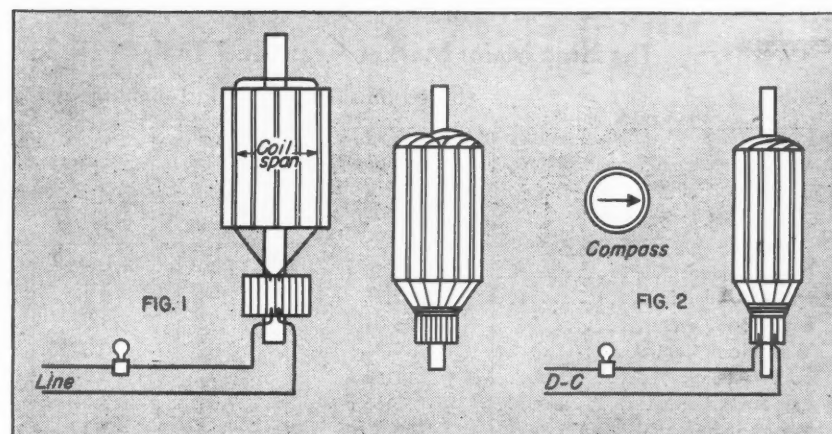


FIG. 1—Test to determine position of leads and lead swing.

FIG. 2—Test to determine direction of winding in each coil.

**Rewinding universal armatures requires critical winding data. Time-saving methods for testing winding direction and lead positions are described.**

sheet iron, or a blade is then passed around the core and two slots which are magnetized, noted and marked. Since there are usually at least two loops to a coil it is necessary to repeat the above operation on adjoining commutator segments until the position of all leads from this slot is located. From the results of this test the position of leads (item 3) and lead swing (item 5) can be easily determined. It also checks the coil span.

## Direction of Winding

**TEST 2** For this test direct current is required. If no regular d-c supply is available, rectified a-c may be used or else a battery. It is also necessary to have on hand a sample armature the winding data of which, are known. For the purpose of this test we will assume that items 1 and 3 are the same in both armatures. The two armatures are placed on a wooden bench, approximately six inches apart, and a compass is placed between them. The d-c test leads are applied across several commutator segments of each armature, alternately (Fig. 2). The position of test leads on the commutator must be such that the magnetized coils are in the vertical plane. Now, if the compass needle points in the same direction in both cases then it is evident that in both armatures the coils are wound in the same direction and vice versa. Care must be exercised to have

the compass in such a position that the needle does not jam. Also, in order to make certain that the compass is not under the influence of a stray magnetic field it is advisable to reverse the test leads at each commutator and note that the compass needle does likewise.

From the foregoing it might appear that in order to take care of all possible combinations of lead position and coil sequence (items 1 and 3) it is necessary to have on hand four sample armatures. Actually only one such armature is required and for the following reasons:

Since only items 1, 2 and 3 of the winding data affect the direction of the magnetic field, it is obvious that the same compass reading in the above test will indicate—either that all three items are the same in both armatures or two of the items are opposite. On the other hand, reverse compass reading will indicate that either one, or all three items are opposite. However since items 1 and 3 have already been determined from Test 1 the choice remains only for item 2, namely whether the coils are wound clockwise or counter-clockwise.

The above tests, if correctly applied will save considerable time in taking winding data of armatures. And it will be found that the aforementioned tests will provide a reliable check in winding universal type armatures in the average shop.

### The Nine Major Market Areas and Their Share in 1948 Appliance Sales

(Based on shipments in first eight months of 1948)

Region	Percent of total residential & rural electric customers	Percent of Total U. S. Sales of . . .				
		Washers	Ironers	Refrigerators	Ranges	Water heaters
New England.....	7.19	5.49	5.05	6.69	5.01	4.99
Middle Atlantic.....	21.75	17.92	18.24	20.85	13.09	13.45
East North Central.....	22.01	21.71	25.08	21.61	21.91	21.88
West North Central.....	9.36	10.82	10.32	10.19	11.55	13.42
South Atlantic.....	11.66	12.99	9.09	12.45	18.11	20.82
East South Central.....	5.65	7.01	3.69	5.71	9.26	8.03
West South Central.....	8.30	9.18	7.37	8.70	3.92	2.68
Mountain.....	3.18	3.52	4.55	3.34	4.93	5.25
Pacific.....	10.90	11.36	16.61	10.46	12.22	9.48

# COMPETITION RETURNS to Appliance Industry

**Outlook good for wired appliances through 1949;  
clothes dryers, ranges, dishwashers make sales gains.**

**T**HE year 1948 was unquestionably the greatest that appliance manufacturers and merchandisers have ever seen. In unit and dollar sales it exceeded any other year in the industry's history and, in the light of trends revealed during the last quarter, its grand totals will probably surpass overall sales marks likely to be attained during 1949.

Production estimates by *Electrical Merchandising* for its 28th Annual Statistical and Market Planning Issue reveal that for the first time since the end of the war, manufacturers were able to meet the demand for nearly every type of major appliance.

Among those heavy appliances requiring special wiring, the electric range was a star performer, moving up from a 1947 total of 1,200,000 units to a 1948 figure of 1,600,000. Dishwashers climbed from 100,000 units to 225,000. Garbage disposers went from 100,000 to 175,000. The newest of the wired appliances, the clothes dryer, went to 75,000 consumers in 1948 as compared with only 58,000 in 1947.

The only major appliance which declined in 1948 was the storage type water heater, sliding from 1,100,000 units to 1,040,000. But, as *Electrical Merchandising* pointed out, it was more remarkable that the appliance so nearly held its own. It was one of the first appliances to reach peak production following the end of the war and the pent-up backlog of demand was quickly reduced.

Home freezers, another of the newer appliances, began to live up to some of their enthusiastic advance notices when they piled up a 1948 sales total of 675,000 units as compared with 450,000 in 1947. Dealer inertia and a lack of consumer understanding of the benefits of this appliance combined during the early postwar years to retard sales, but by early 1949 intensive advertising, dealer and consumer education and aggressive promotion were beginning to make a dent in sales resistance.

Refrigerator sales soared from a 1947 figure of 3,400,000 to 4,530,000 in 1948, but the latter figure represents an evening of supply with demand, and

dealers in various parts of the nation are already reporting that refrigerators now have to be sold.

While standard AM radio sales slumped in 1948, the rise of AM-FM and television receivers was enough to offset dollarwise most of the decrease in unit sales. Television, of course, is the phenomenon of the day. Sales jumped from a meager 178,600 in 1947 to 850,00 in 1948—and this despite the extremely limited market. Sales will continue to rise at the same or even a greater rate in 1949 as more transmitting stations go on the air and more markets are opened.

Automatic and conventional washer sales climbed in 1948 to a total of 4,595,600 units, over 400,000 more than 1947's 4,155,060, but sales in the final quarter and in early 1949 indicate that no such gain will be made this year. Nearly 20 percent of all washer sales fall into the automatic category, which, combined with the fact that nearly 46 percent of all washer sales are replacement sales, indicates that the automatic is moving steadily into homes.



# Summary of Unit Sales and Retail Value of Appliances and Radios, 1947-1948

1947

1948

Product	Number Sold	Retail Value	Number Sold	Retail Value
Air conditioners.....			90,000	\$40,500,000
Bed coverings.....	550,000	\$23,650,000	650,000	27,950,000
Cleaners, vacuum (floor type).....	3,800,687	285,368,000	3,500,000	268,345,000
Dishwashers.....	100,000	23,500,000	225,000	61,875,000
Disposers.....	100,000	12,500,000	175,000	19,250,000
Dryers, clothes.....	58,000	12,180,000	75,000	17,625,000
Fans, attic & vent.....	390,000	24,767,500	325,000	20,000,050
Freezers, home.....	450,000	129,150,000	675,000	202,500,000
Heaters, radiators.....	1,865,600	26,110,000	1,300,000	16,900,000
Ironing machines.....	599,250	75,821,800	470,000	65,221,900
Oil burners.....	820,923	386,532,800	460,046	.....
Oil space heaters.....	1,876,300	159,485,500	1,400,000	120,400,000
Radios, all types.....	18,500,000	1,251,444,500	16,000,000	1,216,550,000
Ranges.....	1,200,000	276,000,000	1,600,000	376,000,000
Refrigerators.....	3,400,000	867,000,000	4,530,000	1,177,800,000
Stokers, residential.....	61,597	.....	75,550	25,900,000
Washers, electric.....	4,155,060	557,670,000	4,595,600	732,353,600
Water heaters, storage.....	1,100,000	143,000,000	1,040,000	143,000,000
Water systems.....	730,000	84,000,000	650,000	89,050,000
Small kitchen appliances.....	14,215,000*	225,035,000*	14,220,000	287,721,250
Other small appliances #.....	23,514,000	228,562,000	20,600,000	214,475,000

\* 1947 figures do not include blenders and broilers. Other small kitchen appliances included are coffee makers, hot plates, grills, mixers, roasters, sandwich grills, waffle irons, and toasters.  
# Small appliances include clocks, irons, heating pads, and shavers.

Lamp bulb and tube sales, which in 1948 reached a record total of 1,831,000,000 units, included an estimated 575,000 germicidal lamps. Their special nature and requirements for out-of-the-way mounting indicate extra work for wiring contractors as sales continue to grow. Some lighting industry specialists have predicted that permanently mounted sun lamps will over-shadow portable units saleswise, a prediction which gains support from the nature of the industry's newest sun lamp developments, the fluorescent.

Among those appliances which failed during the past year to attain 1947 totals were irons, vacuum cleaners, ironers, oil burners, and various small appliances. Some of these, like electric irons, caught up early with the demand backlog and they threw the shadow of a buyer's market on the industry even before it was officially recognized in the first quarter of this year.

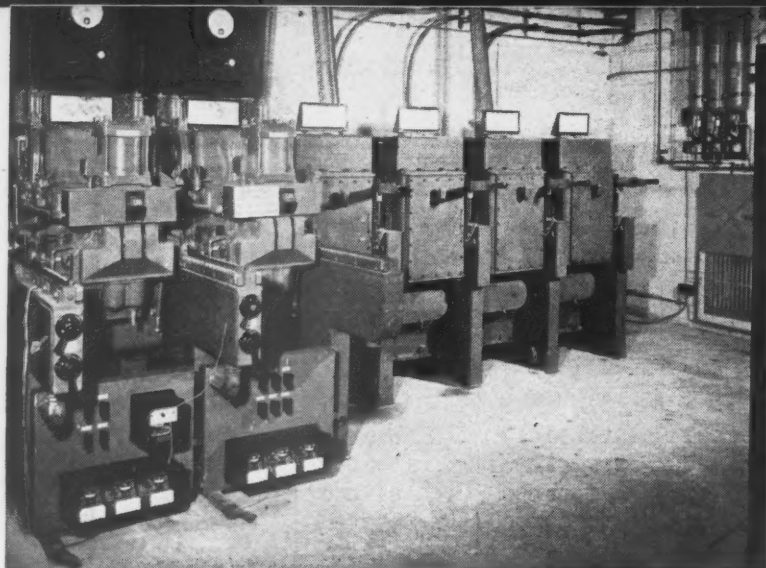
Not all 1948 sales were the result of war-built demand. During the year some 2,155,360 new customers were added to the nation's power lines,

raising the total of domestic and farm electric customers to 35,205,360, according to *Electrical Merchandising*. The biggest gain was registered among urban electric customers, 23,551,140 as compared with 22,366,466 at the beginning of the year. Rural non-farm customers increased from 6,912,534 to 7,392,475 and farm electric customers increased from 3,771,000 to 4,261,745.

From figures provided by 203 power companies serving 25,683,797 residential and rural customers the magazine estimated that the number of electrical appliance dealers has increased 76.4 percent since the beginning of the war. Obviously, this is a lot of dealers. Many of them, especially the newer ones, are already feeling the pinch of a competitive market and in metropolitan areas are betraying their discomfort by a wave of price cutting. Inevitably, some of them will be squeezed out of business and it seems logical to expect an increase in dealer failures during 1949. As a corollary, it would also seem logical that this will not be an advantageous year for a newcomer.

The gain in the number of dealers has been accompanied by a decline in the number of electric utilities which actively merchandise appliances. At the beginning of 1948 some 54.5 percent of the power companies sold appliances and 45.5 percent did not. The latest survey reveals that the balance has shifted in the other direction; 46.7 percent merchandise and 53.3 percent do not merchandise. The decision to get out of merchandising was made by some utilities for any one or several reasons: the large number of dealers, the shortage of merchandise, a lack of trained sales personnel, and shortages of generating capacity.

Despite the fact that 1949 opened the door to a buyer's market in appliances, sales should continue to be good by comparison with any pre-war year or with any postwar year except 1948. The public, by its continued high-level purchasing of even those appliances which have a high saturation, and the dealer, with an ever-increasing emphasis on promotion and active selling, make that evident.



Switchgear for 11-kv. distribution includes oil circuit breakers for incoming power, an auxiliary 1250-kva. transformer, and panels for control of cross-connection to second substation as well as three feeders running to six rectifier OCB's for high-tension supply of transmitter valve anodes.



Each substation includes a vertical control panel which is laid out in the form of a mimic single-line diagram of the distribution system. Meters, controls and indicating lights facilitate efficient operation of the system.

**S**TATED in elementary terms, the purpose of a broadcasting station is to transform sounds and electric power into forms which can be transmitted over long distances with maximum reception. An excellent example of this is provided by the British Broadcasting Company's transmitting station at Skelton, in Cumberland. Located on the North Cumberland uplands 600 feet above sea level, and including 51 aerial arrays supported by 31 masts varying in height from 200 to 350 feet, the site covers more than 750 acres and has a total transmitting output of 1500-kw. This tremendous power beams short-wave broadcasts in 36 languages to all parts of Europe, Asia, Africa, the Americas and (over a 100-kw channel) to certain areas of the Pacific, 14,000 miles distant. Built during the war years and opened in 1943, the Skelton station was of vital military assistance and proved capable of transmitting effective broadcasts in spite of powerful enemy interference.

Designed to give maximum protection to personnel and equipment against air attack, the station structures are squat, reinforced concrete buildings and, for the same reasons of protection, the station's 12 transmitters are paired in separate enclosures with auxiliary equipment located in adjacent concrete housing.

Individual transmitter assemblies, housed in metal cubicles with glass-panelled inspection doors and extending 30 feet or more in length, are controlled from booths positioned between each pair of transmitters, so arranged that each control engineer faces the transmitter for which he is responsible. From these control booths, engineers

can remotely start and regulate the various motor-driven supply machinery, cooling plants and rectifier units. Visual indication of the position of all relays and circuit breakers is provided by lighted bullseyes, and instruments are provided for reading supply voltages and other pertinent data. Also adjacent to the control engineers are final sections of the line input equipment, program meters to indicate the fluctuations of incoming music and speech, monitor receivers and loudspeakers, and controls for switching aeri-

Power for the station is received at 11-kv., 3-phase, 50-cycles by two high-tension substations and, as an emer-

gency secondary source for power, six 500-kw. diesel-engine-driven alternators are installed on the station property. Further protection against complete failure of service is provided by a cross-connecting line between these two substations. Incoming feeders terminate in oil circuit breakers at each sub-station and power is then carried to high-tension busses, cross-connections, and plant distribution systems.

Control for this main system is from a panel adjacent to the power house, the panel being laid out in the form of a mimic line-diagram of the system with the position of all breakers indicated by changing red and green lights. Meters (indicating and recording) and

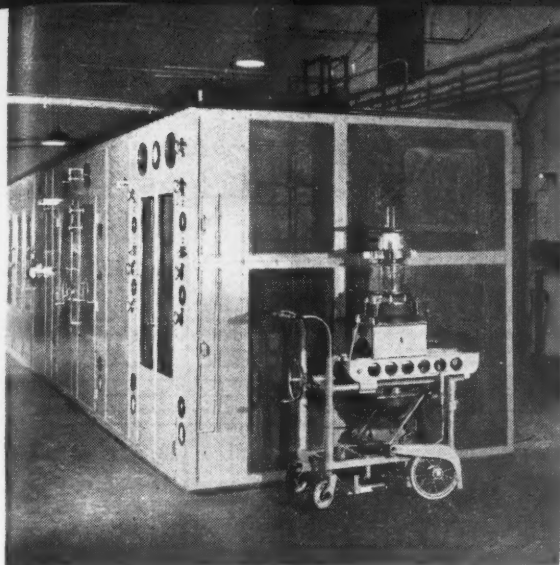
## LONG RANGE POWER

**To maintain effective broadcasting ranges of 14,000 miles, the British Broadcasting Company's 1500-kw. transmitting station at Skelton combines multiple power sources and dual distribution systems with exacting control and safety provisions for equipment and personnel.**

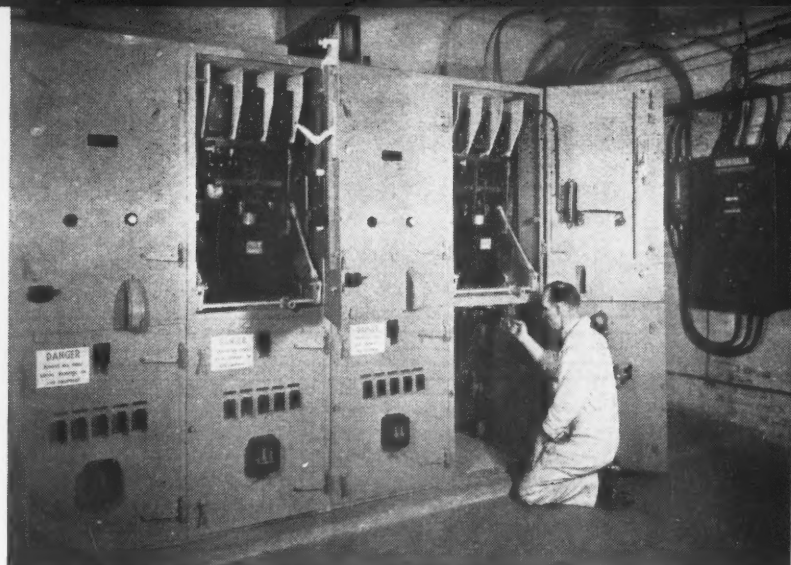
**By J. H. M. Sykes and S. C. Heward**

*Marconi's Wireless Telegraph Company*

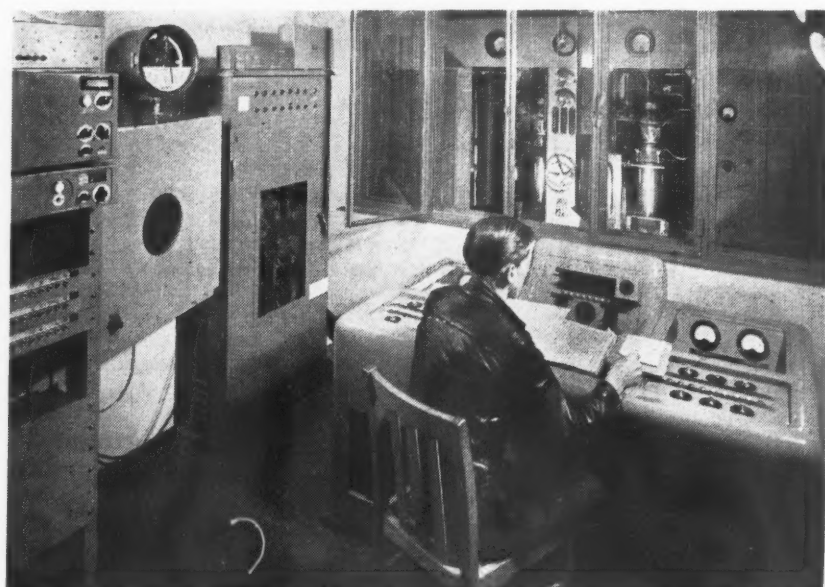
*English Electric Company*



Each of the station's 12 transmitters is approximately 30 feet in length, protected by steel enclosures with glass-panelled inspection doors. For maximum protection, transmitters are paired in separate enclosures.



Low-tension distribution throughout the plant is at 415 volts, controlled by air-break switchgear located directly above main substation control rooms. This 415-volt power is delivered by two 1250-kva. auxiliary transformers housed in separate fireproof cubicles.



Each transmitter has its separate control booth containing line input equipment, monitoring loudspeaker and aerial remote-control switching panel (left) as well as indicating meters and lamp signal panel. Engineer faces transmitter for which he is responsible and can control all key operations of station from this station.

controls (regulating and governing) are positioned on the face of this board.

Two distribution systems are used to carry power throughout the plant. A high-tension system at 11-kv. serves rectifier transformers while a second system at 415-volts feeds the majority of auxiliaries. This 415-volt power is delivered by two 1250-kva. auxiliary transformers housed in separate fireproof cubicles with air-break switchgear for circuit control. Distribution throughout the plant is by lead-covered cables, adequately supported and protected. A 240-volt d-c battery installation adjacent to the 415-volt a-c switchroom provides current for tripping, indicating and control purposes.

Batteries are charged through a glass-bulb rectifier.

Safety was a major consideration in design, and protection is provided for equipment and personnel against faulty operation, overloads and maladjustments. Panels are screened and protected, electrical and mechanical interlocks are fitted to all doors giving access to high potential apparatus, and transmitter circuits are equipped with safety relays. Elaborate precautions are taken against failure of water and air supplies for cooling purposes. At all times, indication of all current, voltages, temperatures and flow rates can be observed by supervising control engineers in the various control booths,

and complete operation of the station can be managed from these points.

Nine music-quality lines connect these Skelton transmitters with the various studios throughout the country where programs originate. On reaching the station, incoming programs are amplified and modulated so that both loud and soft passages are kept at levels best suited for effective long-distance transmission. As power is gradually built up, valves with water-cooled anodes are utilized for more effective heat dissipation, the penultimate modulator stage including valves capable of dissipating up to 75-kw. on the anodes.

To facilitate this dissipation of heat, cooling water is circulated in direct contact with external metal anodes and, for this purpose, anodes are seated in jackets through which water is pumped at the rate of from 16 to 20-gpm. Since anodes are at full potential, elaborate precautions are taken to insulate them from the earth and, in this connection, cooling water is distilled, it is passed through long coiled-rubber hoses between pumps and anodes, and the circulating system is completely closed.

In the final modulator stage, the giant audio-frequency output transformer is of special design, carrying peaks of 20-amps, at 7,000 volts in the primaries, and 14-amps. at 10,500 volts in the secondaries. Interpreting these figures into other terms, power magnification is possible up to the huge level of 72-million to one.

The record of the station is worthy of mention, also, for since the station was first commissioned in 1943, shutdowns due to all technical causes have totalled less than 0.04 percent.



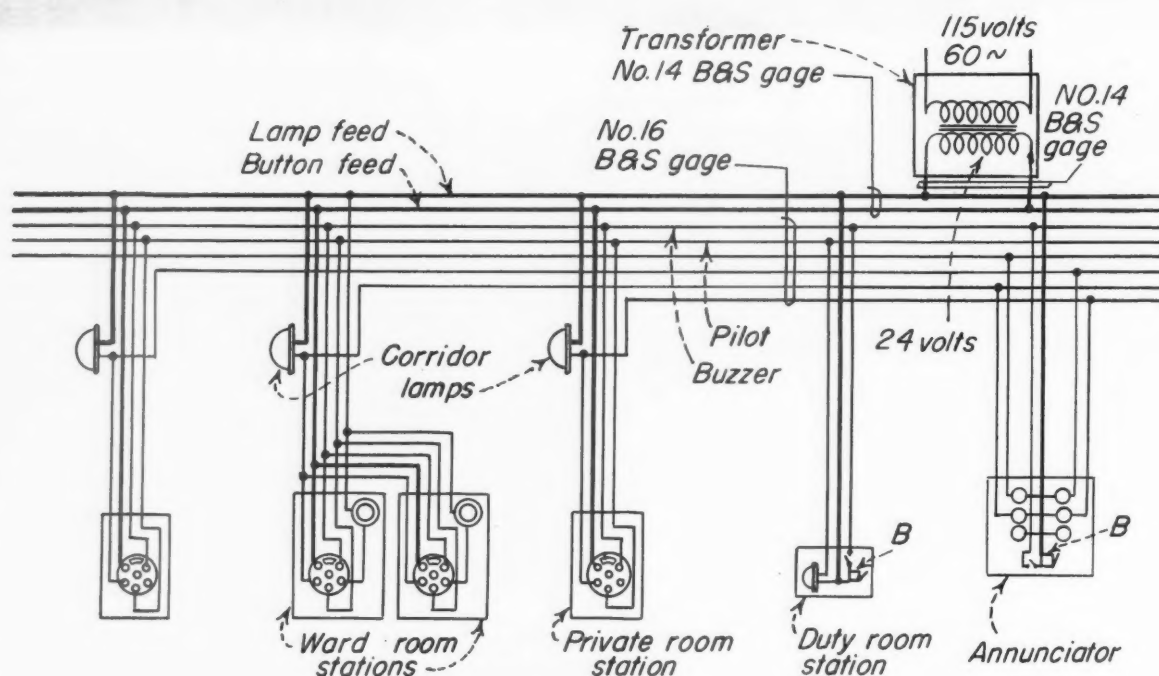


FIG. 1—Wiring diagram of a nurses call system.

# HOSPITAL SIGNAL LAYOUTS

**O**F the signal systems used in hospitals, none are more important than the nurses' call, In and Out and the paging installations. Typical examples of average projects are given in this article. On very large installations the complexity extends to a multiplicity of piloting and supervisory points designed to expedite service and conserve energy and labor.

The method used in the wiring of such systems is again determined by conditions. For existing buildings, exposed work, the individual conductors or cables are enclosed in metal moldings. For new buildings rigid conduit is used.

In laying out an installation the same preliminary precautions should be followed as suggested in previous articles in this series. This is particularly true in the checking of the job plans and the specifications, the manufacturers' circuit diagrams, drawing plans for the electrical construction, charts for wire connections in pull boxes, terminal boxes, terminals in equipment and allowances for spare wires and terminals. The code color charts would be of the same type as that shown in the February 1949 issue of this publication.

**Layout, wiring and power considerations in the application and installation of hospital signals.**

**By A. A. Schuhler**

A typical nurses' call system wiring diagram is shown in Fig. 1. The system functions as follows: The operation of any private room station pushbutton causes the lamps to be illuminated in the corridor outside of the patient's room, in the two duty room stations, and in the annunciator. In addition it causes a buzzer to operate momentarily in the duty room units and in the annunciator. A ward station operates similarly, however, in addition a pilot light is illuminated on the bedside station.

A conduit floor layout based upon the wiring diagram in Fig. 1 is shown in Fig. 2. It indicates typical locations of the equipment comprising such a system and may be made applicable to two wings on a floor, or two floors of a building. As a rule all of the conductors terminate in the lamp an-

nunciators installed in the nurses' stations or chart rooms, and therefore, terminal cabinets are seldom used except on long runs or near corridor intersections. The sizes of the wires and conduit runs are indicated throughout. Alternate choices of running conduit may be followed depending upon the building construction such as is shown on the left and right hand sides in the lower section of the layout. In small installations one source of current such as a transformer may be used. However, in large installations it is preferable and advantageous to use a separate transformer for every floor and for isolated departments or sections of a floor.

In this type of system, the number of wires differ from one point to another, and as a rule the distances between points are very short. For that

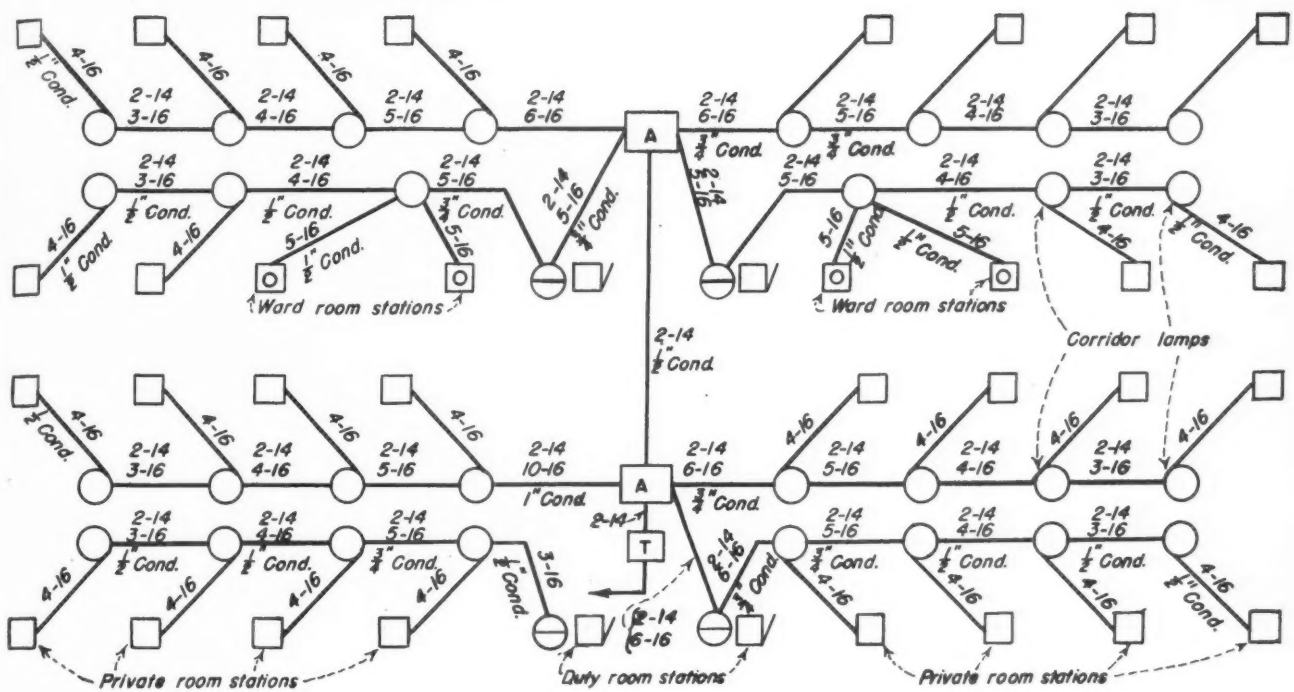


FIG. 2—Nurses call layout.

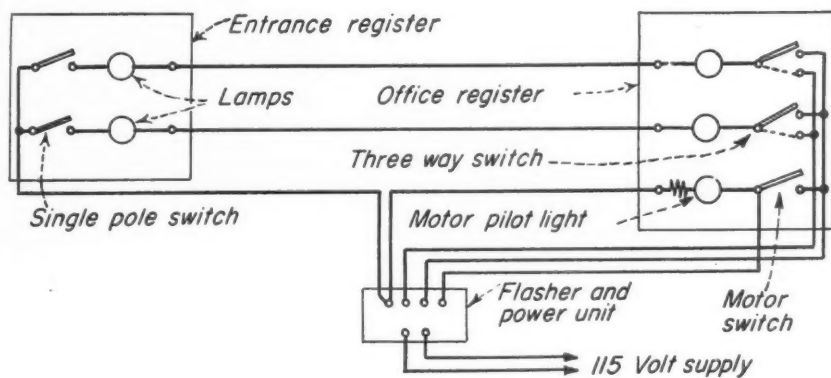


FIG. 3—Wiring diagram of an In and Out register system.

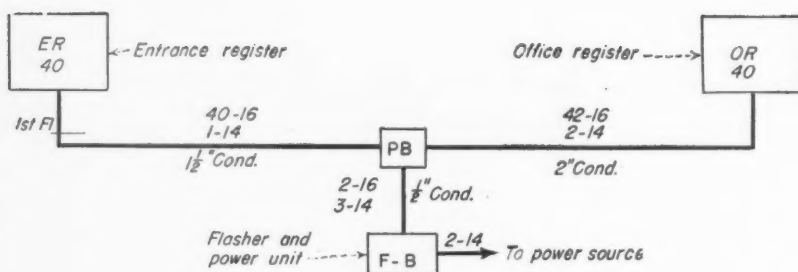
reason cables do not always work out to advantage. However, the wiring between the corridor lamps and the bedside stations used by the patients are duplicated throughout for private rooms and again for the wards and this is where cables are advantageous. A scheme of color coding should be used throughout regardless of the type of wire to be used, that is, individual wires or cables, as suggested in previous articles on signal system layouts. Annunciators are generally equipped with terminal strips by the manufacturers. Since the lamps contained therein indicate the rooms where the signals originated, the color-coded wires are connected to the terminals corresponding thereto. A color code chart should be enclosed in every annunciator.

In nurses' call systems using pilots

at the nurses' stations or chart rooms, the wiring is simplified inasmuch as all section wires are eliminated. However, such pilots only indicate the general direction of the calls. As an example we again refer to Fig. 2. The simplest method of piloting is to have a pilot lamp in the nurses' station consisting of one lamp under a dome with an associated buzzer. The illumination of the lamp would only designate that a call had been made, however, it would be necessary to look in either direction down the corridor in order to determine which room made the call, this being indicated by an illuminated corridor door lamp. A pilot station having two domes with a lamp under each, one dome with two lamps divided by a barrier or two bullseyes, would show whether a call originated in the left or right hand half of the corridor. This

plan should also be extended to the duty room stations. Either one or two buzzers may be used as the audible signal. Pilot stations having bullseyes may also be used to designate common calls from the private rooms with individual lamps for each ward. The pilot system while not accurate as the annunciator system lends itself to the use of cable since the number of conductors are generally alike throughout the installation.

A typical In and Out register system wiring diagram is shown in Fig. 3. The system functions as follows: The operation of a switch in the entrance register illuminates the adjacent lamp and in addition causes an associated lamp to be illuminated in the office register. These lamps operate steadily until the switch is returned to the "off" or original position, which action causes the lamps to be extinguished. The switchboard operator or other office attendant may operate a switch in the office register adjacent to the lamp corresponding to the name of the person to be signalled. In doing this after the desired person has registered "In", the original illuminated lamps flash at frequent intervals. This indicates that a message, mail or a person awaits him in the office. Should the operator actuate the switch in the office register before the desired person has registered "In", such action will merely prepare the circuit to flash the lights when the corresponding entrance register switch is actuated. A trans-



former is used to supply current and is combined in a cabinet with a motor-driven flasher.

A conduit layout for the In and Out register system is shown in Fig. 4. It indicates the relative locations of the entrance and office registers and the flasher and power unit. Practically all of the wiring is run between the two registers with the exception of the power wires, the pilot lamp wire and the motor control wire for operating the flasher and power unit. The registers have a capacity of 40 indications in this case and the wiring is based upon such an installation. The sizes of the wires and the conduit runs are indicated throughout.

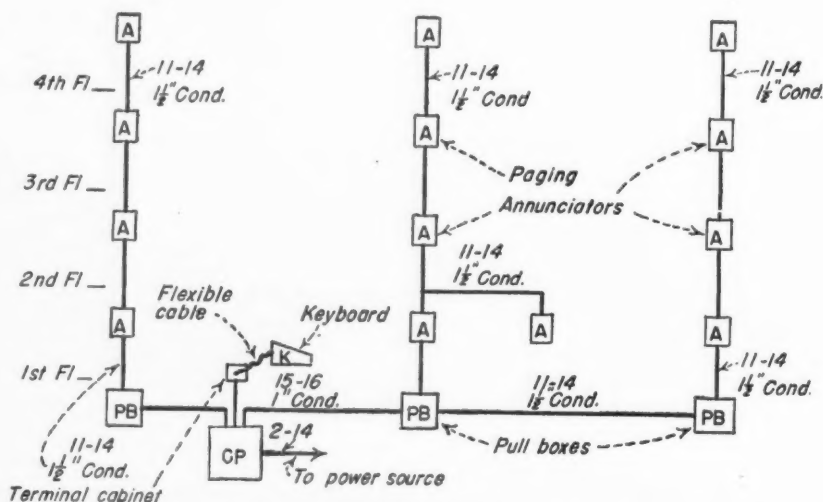
### Use Color-Coded Cable

In this type of system the number of wires are duplicated between the two registers. In fact this is true of any In and Out system. Therefore, it is advantageous to use color-coded cables. It will be noted that a few extra wires are necessary from the pull box and the office register to take care of the flasher control system feature. A cable may be selected with the necessary number of No. 14 and 16 B and S gauge wires. However, since such a cable is considered special it would be advantageous to **secure a cable with wires of No. 16 gauge in which case some wires may be multiplied to the equivalent value of the larger wire to carry the power.** A color-code chart should be made up as suggested previously and fastened to the inside of the registers and the pullbox. If a pullbox is located as shown, terminals should be mounted therein and properly marked so that wires may be readily traced. Such a cabinet must contain at least 43 terminals. In the event that the flasher and power unit is located directly below the office register the pull box may be eliminated **on average runs of conduit between**

the two registers. On long runs a pull box is desirable but it is not always necessary to enclose terminal strips. Where cables are run from one building to another, terminal strip cabinets should be installed near the point where the cables enter the buildings.

The paging system which follows is of the flashing visual lamp annunciator type controlled from a keyboard adjacent to the switchboard operators location. The lamp annunciators contain ten lamps and their compartments are marked from one to nine and zero. The keyboard may be had with either three or six rows of keys which allows the paging of either three or six persons. When the code numbers consist of three digits such as 123, 256 etc. as many as 120 persons may be called. This number may be increased by using code numbers of two, three and four digits. Corresponding numbers appear on all annunciators simultaneously. The lamps in the annunciators operate on 115 volts. The keyboard operates on a lower voltage in conjunction with equipment in the control panel.

A typical riser diagram of a flashing



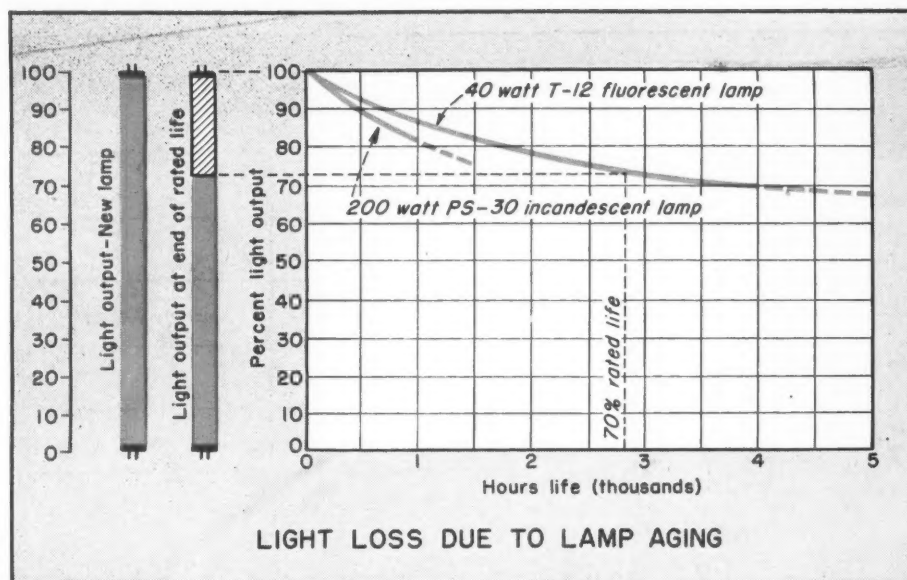
visual paging system using lamp annunciators is shown in Fig. 5. Annunciators are usually installed in the same relative positions on each floor so that a floor layout would merely show the locations of the annunciators and the conduits running either up or down or in both directions. Since the number of wires used to connect the annunciators are duplicated throughout, it is of great advantage to use color-coded cable. Each annunciator contains terminal strips and the wires are carried from one unit to another so that pullboxes as a rule are not used except at the bottom of the risers as shown. These pullboxes should be equipped with terminal strips for ease in isolating and testing the circuits. Each terminal strip must be designed to carry the load at 115 volts and must have at least eleven terminals. In the event an audible signal such as a buzzer or chime is used as an auxiliary signal the number of wires must be increased to twelve and the terminals increased to the same number.

The control panel consists of the necessary relays, fuses etc. and is interconnected with the keyboard by means of a cable which operates on low-voltage. These conductors terminate in a terminal cabinet provided by the manufacturer. A flexible cable furnished by the manufacturer is used to connect the keyboard to the terminal cabinet. All wires should be color-coded and a chart placed in the control cabinet, pullboxes and terminal cabinet. Single call systems using the same type of annunciators are occasionally used in smaller buildings. They require the same number of wires between the annunciators, and also between the annunciators and the keyboard.



# PLANNED LIGHTING MAINTENANCE . . . . .

## Light Loss Due to LAMP AGING



### SIX MAJOR CAUSES OF LIGHT LOSS IN LIGHTING SYSTEMS

Lamp Depreciation . . . . Low Voltage . . . . Low Reflection Surfaces

Lamp Outages . . . . . Luminaire Inefficiency . . . . . Dirt and Dust

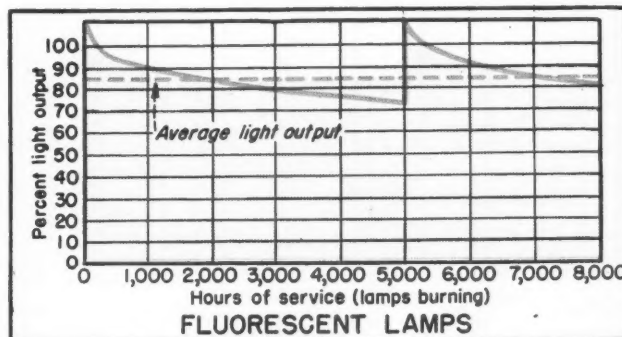
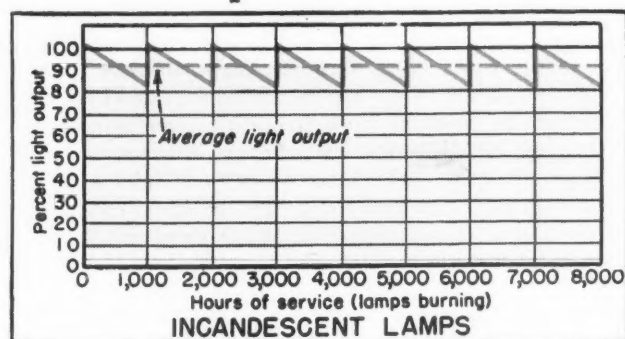
**T**HE maintenance of lighting systems is necessary to keep light loss at a minimum. Light loss is paid for at the same rate per footcandle as the useful light which reaches the working plane. Thus lighting maintenance becomes an important economic consideration in the operation of the millions of artificial lighting installations now in use.

Light loss can be caused by several factors. There are six causes, however, which are of primary importance and account for perhaps 90 percent of all depreciation of light output in a lighting system. These are the six principal factors which are considered by the illuminating engineer when designing a new lighting system, and by the maintenance engineer when planning a lighting maintenance program for an existing lighting installation.

In planning a new lighting system the illuminating engineer takes into account the light loss from all factors. He may

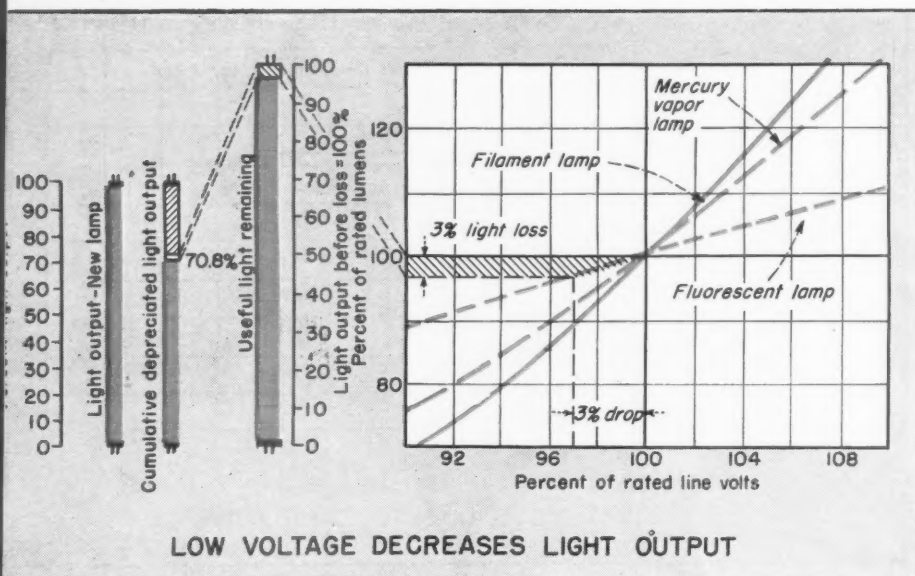
do this on a rule-of-thumb basis, or he may carefully analyze and evaluate each factor. By putting an average value on each factor, he can design for "average" maintained levels of illumination. However, by putting a specific value on each factor, after careful analysis of the effect of that factor under specific conditions, known or assumed, the illuminating engineer can design his lighting system much more accurately and be assured of getting a desired specific lighting result.

In planning a maintenance program for an existing lighting installation, the maintenance engineer faces a different problem. By critical evaluation of the several factors which cause light loss, he can accurately determine the light loss which results from each factor under the existing operating conditions. With this information at hand, he is able to more accurately appraise each factor and the type of mainte-



**Light Output Variations Due to Lamp Depreciation Based on Group Replacements at End of Rated Life**

# Planned Lighting



## Light Loss Due to LOW VOLTAGE

nance program which is needed and can be easily justified.

The accompanying charts and illustrations show the details and effects of the factors within each of the six major causes for light loss, and the cumulative effect of these light loss factors, which result in light output depreciation rang-

ing from 30 to as much as 70 percent. As will be observed, not all this light loss is preventable. However, under average conditions, a good maintenance program should prevent about half the light loss that occurs on existing lighting installations.

In the analysis given here a new lighting system is assumed, and the light output is considered to be 100 percent when the system is first turned on. That is, it is considered that all lamps are new, that rated voltage exists on an adequately wired distribution system, that efficient 2/40-watt new fluorescent industrial reflectors are installed, that the ceiling and side wall painting is new, that the lamps, luminaires, and ceiling and side wall surfaces are clean, and that all lamps are burning. Data are then given relating to each of the six light loss factors, which show the depreciation in light output under varying operating conditions. In order to complete the charts and show the cumulative light loss for all factors, a specific operating condition relating to each factor has also been assumed.

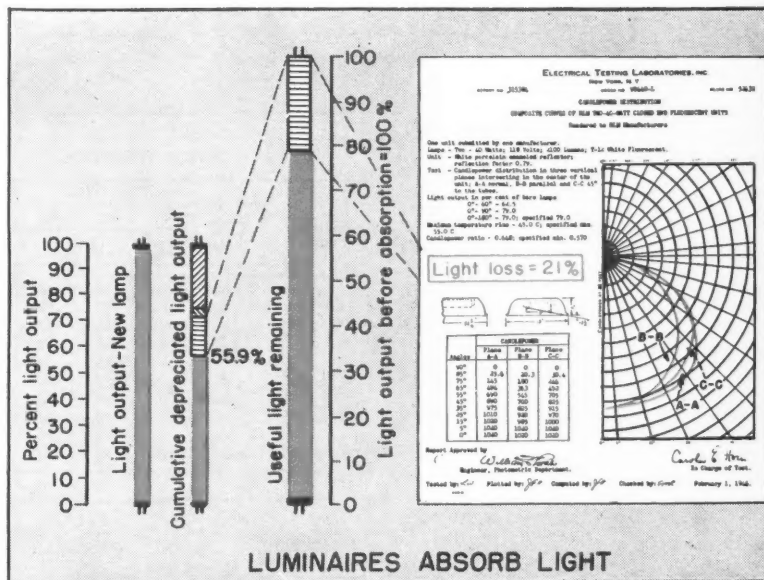
The first light loss factor considered is "Light Loss Due to Lamp Aging". This factor is dependent upon the type of light source used, and the quality of the lamps. Light loss, due to depreciation of the lamps as they are used, is not preventable; but maintenance of proper voltages, clean contacts, and general operating conditions will assure maximum light output during the life of the lamps. An analysis of the lumen depreciation curve for any type light source will indicate the economy of replacing lamps between 70 and 100 percent of rated life. Lamps with short rated life must, of course, be replaced more frequently than lamps with longer rated life. Filament lamps having 1000-hour average life rating require replacement about four times as often as fluorescent lamps under average operating conditions. However, the average light output for short life filament lamps is higher than the average light output for longer life fluorescent lamps.

The light loss value used in the "Lamp Aging" chart was the value at 70 percent of the rated life of fluorescent lamps. This light loss occurs solely due to lamp depreci-

AVERAGE RATED LIFE FOR FLUORESCENT LAMPS		
Type Lamp	Burning Hours per Start	Rated Average Life (Hours)
15-watt T-8 & T-12	3 6 12	2500 4000 6000
20-watt T-12		
30-watt T-8		
40-watt T-12		
All Slimline Lamps		
40-watt T-12 (Instant Start)	3	2500
40-watt T-17 60-inch (Low Brightness)		
100-watt T-17	3	3000
	6	4500
	12	6500

# Maintenance (continued)

## Light Loss Due to LUMINAIRE INEFFICIENCY



ation and does not take into account other light depreciation due to other factors. Therefore, in order to get the cumulative depreciation of all factors, the light loss due to each factor must also be added.

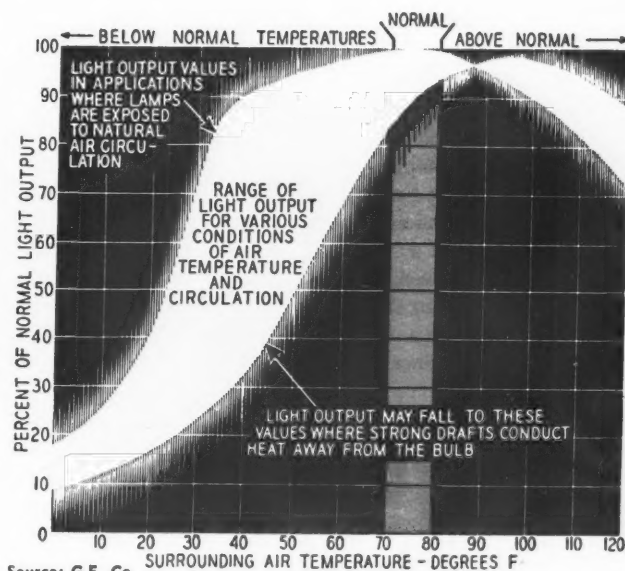
The second light loss factor considered is "Light Loss Due to Low Voltage". The light loss value obtained for the lamps at 70 percent rated life assumed that rated voltage existed. Any drop in voltage due to over-loading of circuits or poor voltage regulation would cause a still further depreciation in light output. A value of three percent voltage drop was assumed, which is not unusual in actual practice. This three percent value applies to the light output of the lamps at 70 percent rated life, and should not be considered as three percent of the initial light output of the lamps (except when all new lamps have been installed).

It is important that rated voltage be maintained on lighting systems for several reasons. Over-voltage will shorten the life of the lamps, especially filament lamps, and will cause over-heating of ballasts on fluorescent or mercury vapor systems. Under-voltage decreases the light output with all type light sources, and also causes unstable operation of fluorescent and mercury vapor lamps.

The third light loss factor considered is "Light Loss Due to Luminaire Inefficiency". All luminaires absorb light. But some luminaires are considerably more efficient than others. This factor is important when a lighting system is being designed, in that the engineer can select luminaires which have a high overall efficiency in lieu of less efficient units.

In the light loss chart a light loss of 21 percent is used for the 2/40-watt industrial fluorescent reflectors, taken directly from a qualified test report on the luminaire. This light loss value applies to the light output of the lamps after depreciation due to lamp aging and low voltage, and not to the initial light output of the lamps under rated voltage conditions, except when an analysis is being made under those conditions.

Once a lighting system is installed with a specific type of luminaire, the light loss factor due to luminaire inefficiency



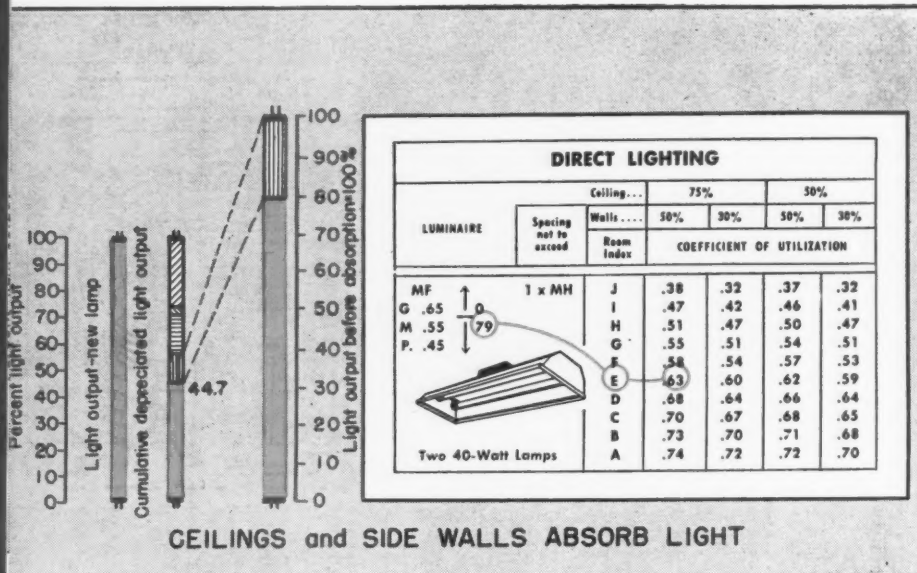
### Temperatures Affect Fluorescent Lamp Efficiency

is of value to the maintenance engineer primarily for two reasons. One is that he will require an overall efficiency test value on the existing luminaires when computing the light losses in the system, and the other is that he can use this factor to make comparison studies to determine how much more light would be obtained if the existing luminaires were replaced with more efficient units.

An important factor to watch for in fluorescent luminaires is the temperature of the air surrounding the lamps. Fluorescent lamps are affected by abnormal temperatures, and by strong air drafts. Luminaires should therefore be properly designed to shield the lamps from air drafts and also ventilated to prevent the lamps from getting too hot. These lamps operate most efficiently when surrounding air temperatures range from 70 to 80 degrees F.



# Planned Lighting



## Light Loss IN ROOM SURFACES

THE fourth light loss factor considered is "Light Loss in Room Surfaces". In order to use this factor, it is necessary to know the reflection factor of the ceiling and side walls, and the Room Index of the room where the lighting is installed and under study. The Room Index is obtained from readily available Room Index tables, and reflection factors can be determined with light or brightness meters, or by comparison of the ceiling and wall surfaces with paint samples on which the reflection values are known. These data are then applied in a Coefficient of Utilization table for the luminaires proposed for or installed in the room. Coefficient of Utilization tables are available in lighting handbooks, or from the manufacturers of lighting equipment covering the luminaires which they make.

In the "Light Loss in Room Surfaces" chart, the Room Index was arbitrarily chosen as "E", and reflection factors were also arbitrarily chosen as 75 percent for the ceiling and 50 percent for the side walls. These data were then applied to the Coefficient of Utilization table for the 2/40-watt fluorescent industrial unit having 21 percent light loss, the type units selected for consideration in this analysis. This Coefficient of Utilization table was taken from the Illuminating Engineering Society's Lighting Handbook. The table shows the coefficient of utilization to be .63, or 63 percent, for Room Index "E", and for 75 percent ceiling and 50 percent side walls. Since the overall efficiency of the luminaire is 79 percent, the light absorbed in the ceiling and side walls is the difference between these two values (.79 minus .63 equals .16), or 16 percent. But since this value applies to the light output of the luminaire, 79 percent, the light absorption is 16 percent of the 79 percent light output of the luminaire, or approximately 20 percent, which value was used in the chart.

The coefficient of utilization for areas lighted with efficient direct lighting reflectors is fairly high. By making this same analysis using other types of luminaires of the general diffuse or semi-indirect type, and for less efficient ceilings and side walls, it can readily be seen that light loss in room surfaces is a major problem in lighting design and lighting maintenance. This fact stresses the need for using high reflection paint on the ceilings and side walls, and for keeping these surfaces clean.

All surfaces in a room, including the floor and machinery, desks, furniture and furnishings, absorb light. The light utilization in a room can be improved by keeping all such surfaces clean, and by using light colored finishes throughout. The elimination of dark finishes on furniture, machinery and other interior equipment also aids in providing a better brightness ratio in the line of vision and better seeing conditions.

This accounts for the current trend in school lighting to lighter finishes for ceilings, side walls, dado and trim, floors, desks and chalkboards. The same principles apply in offices, stores and homes.

COMPARISON OF LAMP LIFE								
Based on Light Output of Million Lumen Hours								
Type Lamps	Rated Life (Hours)	Initial Lumens	Average Lumens	Lamp Burnouts Per Million Lumen Hours				
FILAMENT LAMPS				.1	.2	.3	.4	.5
200 watt PS-30	750	3700	3330					.40
300 watt PS-35	1000	5650	5085					.197
500 watt PS-40	1000	9950	8955					.111
1000 watt PS-52	1000	21500	19350					.052
FLUORESCENT LAMPS				.1	.2	.3	.4	.5
40 watt T-12 3500°	4000°	2310	1964					.127
40 watt T-12 Daylight	4000°	1920	1632					.153
85 watt T-17 3500°	4500°	4200	3570					.062
85 watt T-17 Daylight	4500°	3900	3315					.067
MERCURY VAPOR LAMPS				.1	.2	.3	.4	.5
400 watt T-16	4000°	16000	14200					.0176
3000 watt T-9½	4000°	120000	106500					.00235

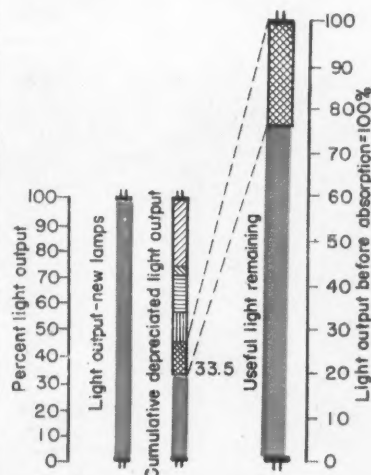
\*Average life based on 6 hours burning per start

\*\*Average life based on 5 burning hours per start

# Maintenance (continued)

## LIGHT DEPRECIATION DUE TO SIX LIGHT LOSS FACTORS

1. Lamp Depreciation (End of Rated Life)
  - Incandescent ..... 20%
  - Fluorescent ..... 30%
  - Mercury vapor ..... 23%
2. Voltage Circuit Depreciation
  - With adequate wiring ..... negligible
  - With poor wiring and overloading of circuits ..... 5-20%
3. Luminaire Light absorption ..... 18-35%
4. Paint Depreciation ..... 5%/year
  - Walls, ceilings, floors and other surfaces all absorb light
5. Dirt and Dust Depreciation
  - One month cleaning intervals ..... 10%
  - Three month cleaning intervals ..... 15%
  - Six month cleaning intervals ..... 20%
  - Cleaned when lamps burn out ..... 30%
6. Lamp Outage Depreciation ..... Up to 12%



LAMPS and REFLECTORS COLLECT DIRT and DUST



## Light Loss Due to DIRT and DUST

THE fifth light loss factor considered is "Light Loss Due to Dirt and Dust". Average depreciation due to this factor is shown in the table "Light Depreciation Due to Six Light Loss Factors". The values in this table range up to 30 percent, but under severe atmospheric conditions and in dirty locations the values can be much higher. In air conditioned areas the depreciation in light due to dirt and dust will naturally be less. The maintenance engineer can determine this light loss factor for a specific lighting installation by making a few spot tests. The procedure is to make some footcandle readings in an area before cleaning the lamps and

lighting equipment, and afterwards when the equipment is clean. The lamps and luminaires should be washed and the old lamps reinstalled in the luminaires before making the second, or "after" set of readings. A rate of depreciation due to dirt and dust collection can be established by making a series of three sets of readings, such as at the end of one, two and four months, or at the end of one, three and six months. In the cumulative light loss analysis shown here a light loss value of 25 percent was assumed, which is considered a conservative estimate for average conditions now found in actual practice.

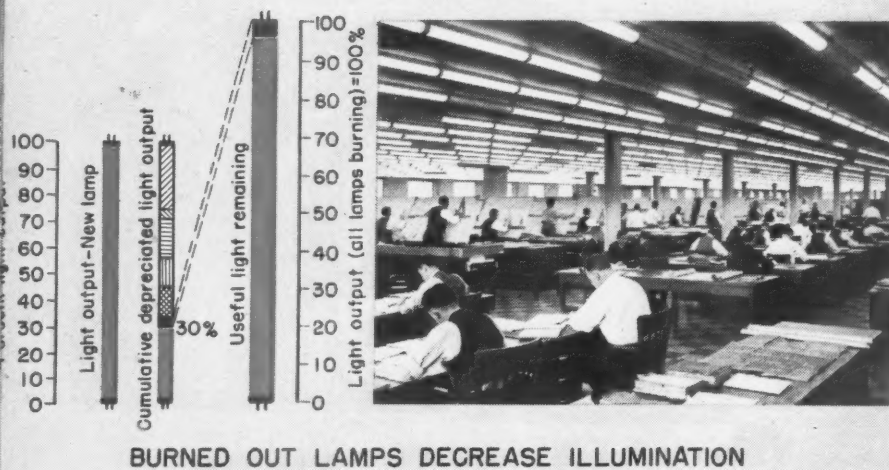
### ILLUMINATION DATA ON LOUVERALL LIGHTING

Based on Tests in an Experimental Office

Louver Cells 2" x 2" x 2", Crosswise and Lengthwise Shielding 45°

Louver Ceiling	Efficiency of Material		Average Footcandles	Coefficient of Utilization	Brightness Candles Per Sq. In.	% Footcandles in Terms of No Louvers
	Refl.	Transmission				
No louvers			169	.43	Bare lamps	100 %
Plastic vinylite	19 %	71 %	138	.35	1.0	81.6 %
Etched aluminum	75.5 %	0	119	.30	1.15	70.4%
White paint	74.6 %	0	102	.26	0.53	60.5%
White paint	67 %	0	88	.22	0.28	52 %
Black paint	4.1 %	0	51	.13	0.025	30%

# Planned Lighting



## Light Loss Due to LAMP OUTAGES

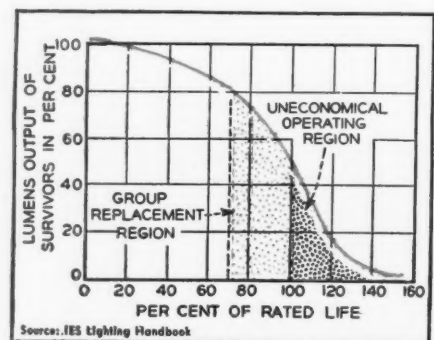
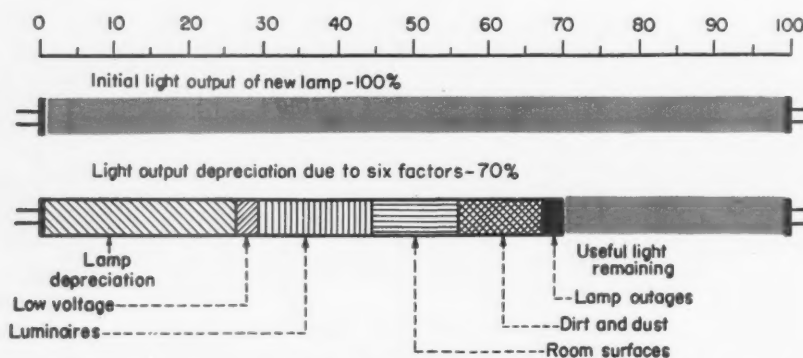
THE sixth light loss factor considered is "Light Loss Due to Lamp Outages". In incandescent or mercury vapor large lamp installations lamps are normally replaced soon after they burn out, as each lamp in such installations lights a fairly large work area and lamp burn-outs cannot be tolerated. However, in fluorescent multiple-lamp luminaire installations, individual lamps burn out often and are not detected for some time. For this reason outages on fluorescent installations often average as much as ten percent or more.

In designing a new lighting system, the illuminating engineer can and should take into account the six light loss factors and the economies suggested by studies of each, during the design stage of the proposed lighting system. He can select light sources which provide high average light output throughout the life of the lamps. He can provide adequate wiring which will give rated voltage at the lamps under normal operating conditions. He can select luminaires which have a high overall efficiency. He can recommend paint colors and finishes for all interior surfaces which have a high light-reflectance value. He can estimate dirt and dust conditions, and select lighting equipment with good maintenance features which will simplify the maintenance problem. He can also recommend lamp replacement sched-

ules which will keep lamp outages at a minimum and lighting intensities up.

In planning the maintenance program for an existing lighting system, the maintenance engineer can also make use of the light loss factor studies. However, he is not always able to make changes which are indicated by the studies as being desirable, and which would prevent some of the light losses. But a thorough knowledge of the light losses which exist, and their exact causes, will be of inestimable value in setting up and having approved a sound and economical lighting maintenance program.

It is not intended to imply by this light loss analysis that indirect or semi-indirect lighting systems are not justified. Lighting intensity on the work plane and its relation to initial light output expressed in percent efficiency is only one of several criteria used to appraise a lighting system or lighting result. But it is intended that this analysis stress the importance and value of *planned lighting maintenance* and indicate the approximate effect each of the major light loss factors has upon the final efficiency of a lighting system. Careful study of each factor as it relates to a specific lighting system should reveal the type of maintenance required for that specific system, and how much maintenance can be justified.





# Maintenance (continued)

**TYPES OF MAINTENANCE EQUIPMENT**  
(For Getting at Lighting Equipment)

Type Equipment	Mounting Height			
	Up to 12 ft	12 to 18 ft	18 to 30 ft	Above 30 ft
Catwalk or truss			X	X
Crane, where available			X	X
Crow's-nest ladder			X	
Disconnecting hanger			X	X
Portable maintenance platform		X	X	
Relamping bridge			X	X
Stepladder	X			
Straight ladder		X		
Telescoping platform, tower		X	X	



One-Man Maintenance Ladder



Two-Man Portable Platform

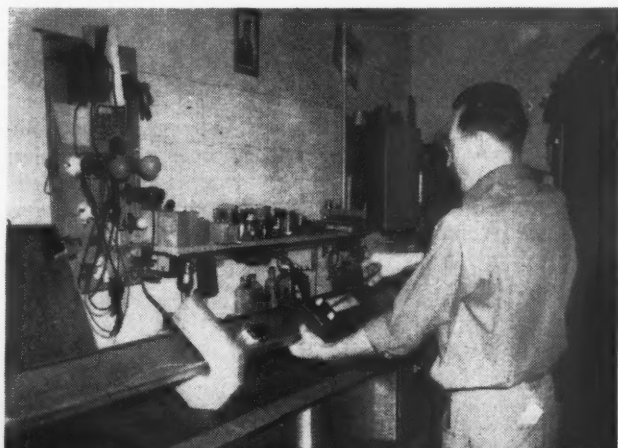
## Lighting Maintenance Methods

In order to maintain lighting systems efficiently it is necessary that the lighting equipment be easily accessible. The equipment manufacturers have done much in the design of their luminaires to make maintenance easy. The lighting engineer can also plan for easy maintenance when designing a new lighting system, by selecting equipment which has good maintenance features and by providing easy access to all lighting units. The maintenance engineer can also simplify the maintenance problem by equipping his department with the types of maintenance equipment and devices needed to do the job efficiently and with a minimum of time and effort.

Too much emphasis cannot be placed on the role of the maintenance engineer in keeping the already installed lighting systems operating at top efficiency. It is his prerogative, and responsibility, to make a thorough analysis of the lighting system, or systems, under his jurisdiction along the lines suggested herein, and to report his findings to his management. The "Lighting Maintenance Check Chart" can be used as a guide in making such analyses and reports. The conditions obtaining on each lighting system vary considerably. These varying conditions and their effect upon the final lighting result should all be studied and incorpo-



Upright Scaffolds



← Fluorescent Test Board, Work Bench and Special Tools

# Planned Lighting Maintenance

## LIGHTING MAINTENANCE CHECK CHART

Lighting maintenance should be planned during the design and layout stage. Some of the major factors to be considered are listed below.

Maintenance Factor	Maintenance required and methods of checking for trouble
<b>(A) Short Lamp Life</b>	<ol style="list-style-type: none"> <li>1. All lamps should be "dated" when installed. This can be done with a rubber stamp dater or grease pencil. The number of hours burned before lamps fail can be estimated, based on average hours burned per week. This will provide reliable data for comparison with manufacturer's "rated life" data.</li> <li>2. If "lamp life" records from actual use show short lamp life, checks of voltage impressed at socket or at ballast terminals should be made periodically over a period of a month, and at different intervals during the day. Records should be kept of each voltage reading. Then, if the voltage readings are found to exceed the lamp voltage rating by more than three or four volts average, or to vary from ballast voltage ratings by more than five percent, corrective measures should be considered. For incandescent lamps, lamps having voltage ratings comparable to actual voltage conditions should be used. For fluorescent lamps, voltage regulators should be installed, or other steps taken to insure proper voltage at ballast terminals. For mercury lamps, transformer taps should be changed to meet the existing voltage conditions.</li> <li>3. If short lamp life still exists after making voltage corrections, the lamp manufacturer should be consulted.</li> </ol>
<b>(B) Low Voltage</b>	<ol style="list-style-type: none"> <li>1. Make weekly checks on voltage at sockets, or at ballast terminal leads, and keep perpetual record. If excessive fluctuations of voltage are indicated, a continuous recording voltmeter should be used.</li> <li>2. If "voltage records" indicate excessive low voltage or wide fluctuations, corrective measures as outlined in (A)-2 should be considered. If circuits are overloaded, consideration should be given to rewiring on an adequate wiring basis.</li> </ol>
<b>(C) Luminaire Efficiency</b>	<ol style="list-style-type: none"> <li>1. In planning a new lighting system, luminaires should be selected which have a high overall light output for the type of lighting system involved.</li> <li>2. In old lighting installations where the luminaires are already installed, the luminaire efficiency should be determined as a matter of record, and compared with other luminaires of similar type. If the installed luminaires are highly inefficient, a cost analysis study should be made covering a new installation of a suitable luminaire of higher efficiency, to determine if a new installation can be justified.</li> </ol>
<b>(D) Low Reflection Room Surfaces</b>	<ol style="list-style-type: none"> <li>1. Determine and record the reflection factor of the ceiling, side walls, floor and furniture or equipment. Checks should be made about twice yearly to determine the rate of depreciation of the reflectance of these surfaces.</li> <li>2. Using a "coefficient of utilization" table for the type luminaires installed and the reflection factors which exist, a series of cost analysis studies should be made to determine if repainting in lighter finishes, or more frequent cleaning of all room surfaces, can be justified.</li> </ol>
<b>(E) Dirt and Dust</b>	<ol style="list-style-type: none"> <li>1. Determine the rate of depreciation of light due to collection of dirt and dust on the lamps and luminaires. This can be done by making accurate footcandle intensity readings both "before" and "after" cleaning the lamps and luminaires with soap and water in a specified area. Such readings should be made for different periods, such as after one week, two weeks, one month and three months. A "light loss" curve can then be plotted from the results of these tests. This curve will indicate the degree of atmospheric pollution which exists in this lighting installation, and aid in establishing a cleaning schedule for all lighting equipment.</li> </ol>
<b>(F) Lamp Outages</b>	<ol style="list-style-type: none"> <li>1. Check the number of lamp outages which occur each week, and keep a file record.</li> </ol> <p>Lamp outages will be influenced by the method used for lamp replacements. If lamps are replaced as they burn out, a spot check of outages at any specific time will show no outages. If lamps are group replaced, for example, at 70 percent of "rated" life, the number of outages will increase rapidly as the 70 percent period is reached.</p> <p>The question of "group" versus "individual" lamp replacements should be studied carefully for each lighting installation. Such studies should include all local conditions, such as size of the installation, ease of getting at the luminaires, ease of relamping the luminaire, degree of dirt and dust accumulation, cost of lamps used, local labor rates, and other similar pertinent considerations.</p>



**Maintenance Men Clean, Repair and Relamp a Lighting System**

rated in these analyses. When an analysis indicates that additional maintenance will result in improved lighting and seeing conditions, these facts should be included in the report, and recommendations made covering a sound maintenance program.

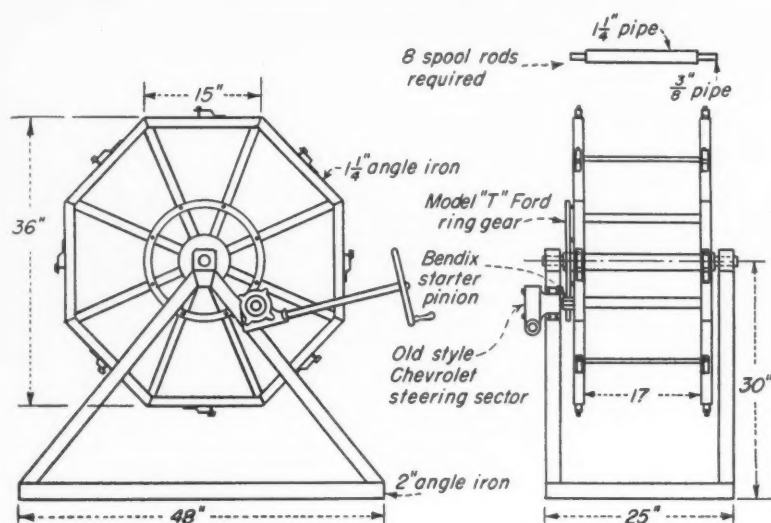
Key to a good maintenance program are *records*, as a study of the Check Chart at left will show. Records are needed on each light loss factor. Such records will provide factual data on each factor under local conditions, and give the maintenance engineer a sound basis for his lighting system analysis and maintenance recommendations. The setting up of a record file on each light loss factor is therefore the maintenance engineer's first, and most important step in planning a lighting maintenance program.

Among the maintenance tools required by the lighting maintenance department, a portable voltmeter and a good illuminometer (or light meter) are highly essential. Without these it is impossible to obtain all the data required to make an accurate and intelligent light loss analysis, or to determine the results of a lighting maintenance program after it is put in operation. Other tools include test boards for testing fluorescent lamps, ballasts and starters, as well as cleaning materials, ladders, portable platforms, etc., described previously.

Realizing the importance of lighting maintenance, especially since the introduction of fluorescent light sources, many electrical contractors have in recent years set up a specialized lighting maintenance contract service. Through specialization, they are able to maintain lighting systems on an annual contract basis at a minimum cost to the owners and at less cost than can be expected by owners who do not have their own regular maintenance departments.

The illuminating engineer has an equally grave responsibility in planning the new lighting systems for homes, industry and commerce. It is his professional responsibility to consider the lighting maintenance problems when designing new lighting systems, and to inform his clients in detail regarding these considerations and findings. No *Planned Lighting* recommendation is complete without such an analysis, and specific recommendations covering a *Planned Lighting Maintenance* program.

# Motor Shops



Sectional views of ferris-wheel wire rack showing construction details and dimensional data.

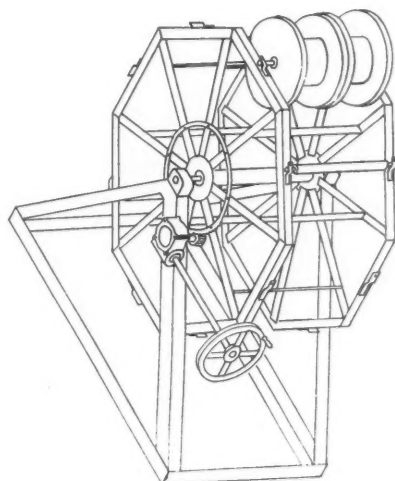
## Ferris-Wheel Rack Stores Wire Spools

A few old automobile parts, some angle iron and a dash of ingenuity was the recipe for a space and labor-saving magnet wire reel rack in the motor repair shop of Zack Brothers Electric, Mason City, Iowa. The device is in the form of a ferris wheel; occupies approximately eight square feet of floor area; holds sixteen 12-inch wire spools; permits reel storage near winding machine.

Designed by Ralph Martinsen of the Zack Brothers organization, the device was entered in the 1948 NISA Awards Contest and is released for publication through the courtesy of the 1948 Awards Committee of the National Industrial Service Association.

The octagonal shaped wheel is constructed of 15-inch sections of 1 1/4-inch angle iron. Spacer bars, 17 inches long, are welded between the spokes of the two wheel sections to provide clearance for the reels. Eight spool rods, consisting of a 1 1/4-inch pipe sleeve on a 3/8-inch pipe shaft, are mounted in clamps on the periphery of the wheel. Each rod accommodates two 12-inch wire spools. The complete wheel assembly revolves on a triangular base (48-in. long; 25-in. wide; and 30-in. high) fabricated from 2-inch angle iron.

A number of scrap automobile parts



Ferris-wheel wire rack holds sixteen 12-inch spools in compact arrangement; is operated by a steering gear mechanism; lines up reels for winding assignments.

were used for the turning mechanism. An old style Chevrolet steering sector with a Bendix starter pinion is mounted to the triangular base near the wheel hub. The pinion engages a Model "T" Ford ring gear attached to the spokes of the wheel. Turning the steering wheel rotates the ferris wheel rack; brings the desired magnet wire spools into position for coil winding. Rotation can be either clockwise or counter-clockwise and no brake or locking attachment is required with the steering gear arrangement.

## Testing Small Motor Fields and Stators

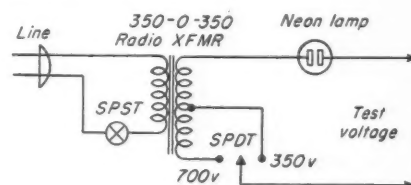
By Bernard M. Rosenberg\*

In determining trouble in small fractional horsepower motors, the testing of the field coils and/or stators is often neglected. Usually a series light is used to check for continuity and grounds. However, this method will not show high resistance shorts to ground or between windings, nor will it show shorted turns in the coils. Although internal growlers can be used on most of the larger motors to determine the presence of shorted turns, they do not lend themselves readily to use in the small motor field.

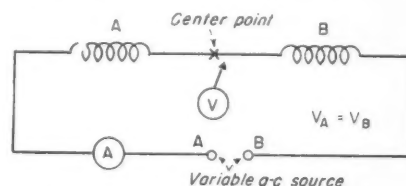
All stators and fields should be tested for the following defects in order to insure satisfactory and long lasting performance:

1. Grounds
2. Shorted turns
3. Continuity
4. Mechanical condition

The ground test should be made with a voltage that is in excess of the operating voltage. An inexpensive method of obtaining this high voltage test is shown in Diagram No. 1.



In order to test a set of coils of any type, whether in a two-pole universal motor, such as a vacuum cleaner, drill, etc., or in a four-pole induction motor, such as a hair dryer, adding machine, etc., one must have available a variable a-c source, an a-c voltmeter, and an a-c ammeter. The equipment is arranged as shown in Diagram No. 2.



For a two-pole universal motor field, we connect the a-c source in series

\*Park Armature Co., 883 Boylston St., Boston 16, Mass.



# KLEIN

## "Pole Master"

### CLIMBERS\*



Gaff is in line with the leg bone.

**1945 POLEMASTER CLIMBERS** Riveted Top Wrought Loop, Triangular Ring at Ankle (average weight) 2½ lbs. per pair. (With this Climber, use Ankle Strap No. 5301-16 or No. 5301-26).

### "solid comfort" for linemen

■ There's greater comfort for the lineman in the new Klein "Pole Master" Climbers. Designed as a real working pair . . . with one climber especially for the right and the other for the left . . . they have an extra wide stirrup for greater arch support.

Leg irons are tough and dependable, yet flexible and tapered in width and thickness. Ankles and calves get better support . . . chafing is practically eliminated. And the scientifically offset shank brings gaff in proper line with leg bone, providing real security . . . solid comfort.

"Pole Master" Climbers are forged from high quality, special alloy steel. A wrought, triangular-shaped ring at ankle assures proper set of ankle strap and provides additional comfort . . . safer, longer strap life. "Pole Masters" . . . like all Klein climbers . . . are individually tested and suitable for linemen of any weight.

\* Matched Right and Left Climbers

#### ASK YOUR SUPPLIER

Foreign Distributor: International Standard Electric Corp., New York

Since 1857

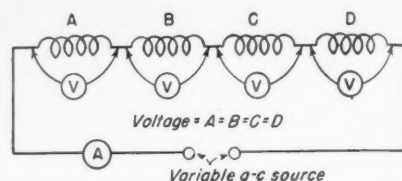


**Mathias KLEIN & Sons**  
Established 1857 Chicago, Ill., U.S.A.

3200 BELMONT AVE. CHICAGO 18, ILL.

with the ammeter and the two coils. There is in this circuit a center point between the two coils to which we connect one side of our voltmeter. The a-c source is turned on and adjusted until approximately twice the normal current consumption of the unit is indicated on the ammeter. The remaining voltmeter prod is then connected first to one side of the a-c line and then the other. The voltages read should be the same. If they are not, it is an indication that there are one or more shorted turns in the coils. If the ammeter fails to read, it is an indication that there is no continuity in the coils.

For a four-or-more-pole field or stator, the circuit is exactly the same with the exception of the voltmeter connections. The voltmeter is used in this case to measure the voltage drop across each coil and all voltages should be alike, as shown in Diagram No. 3.



This method is applicable to the testing of all types of windings where a balanced condition must be maintained.

Besides being electrically sound, the coils must be in satisfactory mechanical condition. This can only be determined by observation. The impregnating material should not be charred, powdery, or flaky. Any oil should be removed from the windings in order to prevent future breakdowns. Any carbon dust, such as accumulates from brush type motors, should be carefully removed and, if necessary, the coils should be reimpregnated with a suitable insulating varnish.

Adherence to these simple methods will insure performance equal to that of new stators or fields.

### Portable Tank for Dipping Armatures

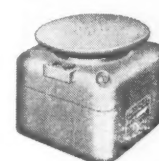
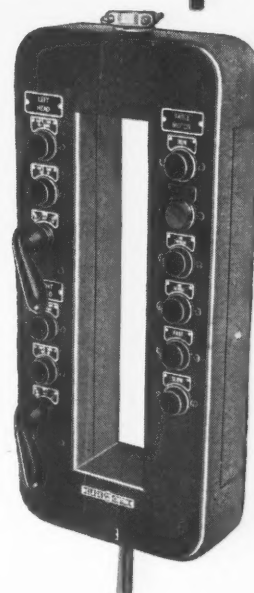
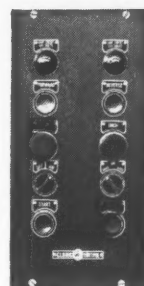
Dipping armatures with long shafts is no longer a problem at Consolidated Electric Company, St. Paul, Minn. President Carl J. Gardeen, has constructed a portable dip tank with an extended bottom to accommodate the shafts.

The heavy-gauge steel tank is 18 inches in diameter and 24½ inches high; has a heavy, hinged, 19-inch diameter, ¼-inch boiler plate cover. A 17-inch extension of 4-inch diameter pipe at the bottom of the tank holds the

# For Every Electrical Actuating Need—there's a CLARK PUSH BUTTON!



Clark Type "D" Heavy Duty Push Buttons are sturdily built to provide outstanding service in heavy duty operations. These Push Button elements and stations are available in a great variety of arrangements, contact requirements, and enclosures, and also include Pilot Light and Selector Switches which are interchangeable with the Push Button elements.

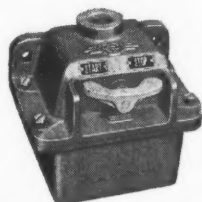


Type D, Form RN "Rough-neck" Push-button for heavy duty service. Below, Form RNG with guard ring.



The following table shows mounting arrangements available

HEAVY DUTY STATIONS AND ELEMENTS			
TYPE	MOUNTING ARRANGEMENT	APPARATUS	ENCLOSURE
D	Surface	Assembled Stations	Standard
D	Surface	Elements Only	Open
D	Flush Plate	Assembled Stations	Pull-box available
D	Steel Panel	Elements Only	Open
D	Steel Panel	Elements Only	Open
D	Surface	Assembled Stations	Dust-tight and Water-tight
D	Surface	Assembled Stations	Class I, Group D Hazardous Locations
D	Pendant	Assembled Stations	Standard
D	Surface or Semi-flush	Mill Button	Cast
DO (Oil Tight)	Steel Panel	Elements Only	Open



Type D—Heavy Duty Push Buttons. Above—for Class I, Group D, Hazardous locations; Below—Dust-tight and water-tight enclosure.



Modifications for surface mounted assembled stations include Mushroom Heads, Hold down rings with lock clip. Snap latch for joggling arrangements, maintained contact elements, and additional contacts on push button elements.

Also available are several types of Standard Duty Buttons for use on ordinary starter applications no larger than NEMA Size 4, 150 ampere size.

Available through your CLARK distributor.



## THE CLARK CONTROLLER co.

EVERYTHING UNDER CONTROL • 1146 EAST 152nd STREET, CLEVELAND 10, OHIO

GENERATE YOUR OWN

# ELECTRICITY

FOR ANY PURPOSE—AT LOW COST

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**Universal** ELECTRIC PLANT

## GASOLINE AND DIESEL MODELS TO 35 kw.

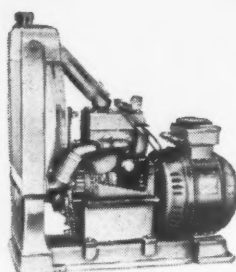
Whether you want a dependable source of electricity to beat the power shortage—or for permanent service or emergency standby use—you'll find exactly the size and type electric plant in the complete Universal line. Here are both gasoline and diesel models, in portable and stationary types—with each model backed by Universal's over 51 years of manufacturing experience. Soundly engineered and of highest quality construction, Universals offer maximum operating economy and dependability. Yet, prices are as low as any.

Universal gasoline powered electric plants are built in sizes from 250 watts to 25 kw., air or water cooled, portable or stationary types. The complete Universal diesel line ranges from air-cooled models of 2000 watts up to powerful 6-cylinder units of 35 kw. All types of controls, manual or fully automatic.

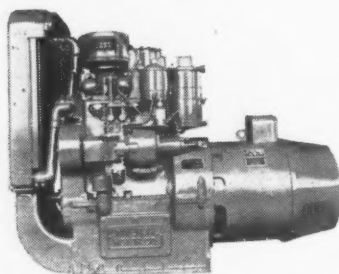


**SEND FOR BOOKLET**, "Electricity at Low Cost," for facts and photos of Universal's gasoline-powered electric plants. Also ask for bulletins on Universal diesel models.

**Contractors and Representatives:** Write for full details on the profitable Universal franchise.



*This small 2-cylinder, water-cooled Universal electric plant provides 2500-3000 watts. Extremely dependable, unusually economical. Other Universal gasoline models to 25000 watts.*

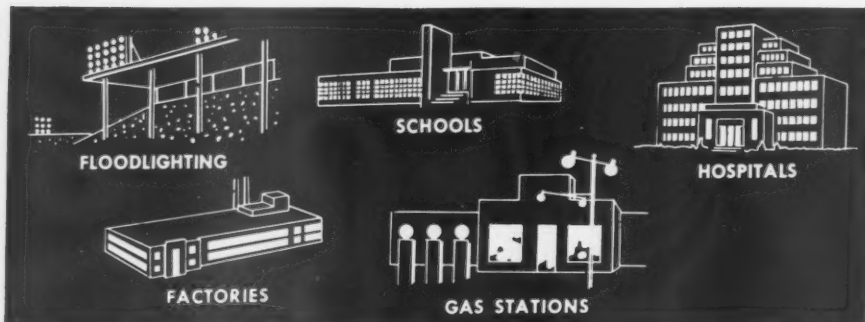


*For 10 kw. of low cost electricity, this Universal diesel-powered electric plant should be investigated. Send for bulletins covering Universal 100% full diesel electric generating sets.*

## UNIVERSAL MOTOR COMPANY

Founded 1898

438 Universal Drive • Oshkosh, Wisconsin



**PORTABLE DIP TANK** has pipe extension on bottom to accommodate armature shafts; frees conventional dip tank for stator work.

armature shaft during the dipping process.

A tripod base with 1½-inch and 2-inch angle-iron braces supports the tank assembly. When in use, the unit can be pushed directly in front of or adjacent to the bake oven; can be rolled out of the way when dipping is completed. Unit releases stationary dip tank for stators and other equipment.

## Slot Stick Storage Rack

A large assortment of slot sticks and insulation tubing is kept within easy reach of the coil winders in the motor repair shop of Boustead Electric and Manufacturing Company, Minneapolis, Minn. It is stored in a bench-mounted vertical rack that keeps the work surface clear at all times; provides quick identification of the complete assortment. Details of this storage rack were reported by Leon E. Sabine in a 1948 NISA Awards Contest entry. Release for publication is through the courtesy of the 1948 Awards Committee of the National Industrial Service Association.

The plywood rack contains 24 "chutes" in double tier arrangement with openings at the front near the bottom. Each chute is 30-inches long and about 2½ inches square inside. Partitions are constructed of ¾-in. plywood; the rack enclosure of ½-in. plywood. A ½-inch high "lip" at the bot-



# ARE YOU SECURING THESE THREE BENEFITS OF HAZARD PERFORMITE BUILDING WIRE?

PERFORMITE--8--RH--600V--HAZARD

*Safer, longer-lasting circuits*

*Faster installations*

*Important savings*

The advantages you gain from Hazard Performite Building Wire, Type RH, are simply the logical results of using better insulation which permits a lighter-weight, smaller-diameter wire for a desired circuit amperage.

Performite Insulation, with its high heat-resistance, (20% greater current carrying capacity than Code grade) means that smaller conductors, voltage drop permitting, carry the same load with greater safety. Thus, particularly on #1 Awg wire and larger—you save initially on copper cost and lower shipping weight... handling and installation are easier and therefore quicker with this lighter, more compact wire... its smaller overall diameter permits smaller, less costly conduit and fittings. And the better grade rubber used in compounding Performite Insulation assures many extra years of safe service.

If you're not already taking advantage of Hazard Performite Type RH Building Wire, it will pay you to talk to your Hazard representative before planning your next installation. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pennsylvania.

Quick Comparison Chart of Typical Savings with Performite Type RH Building Wire for Five Common Circuit Amperages Where Voltage Drop Is Not Excessive.

TYPE	SIZE AWG	O.D.	WEIGHT PER 1000 FT.	CONDUIT FOR 3 CONDRS.	APPROX. SAVING PER 1000 FT.*
100 AMPERE CIRCUIT					
R	1 (110 Amps.)	.56"	364	1½"	\$35.00
RH	2 (115 Amps.)	.48"	278	1¼"	
200 AMPERE CIRCUIT					
R	250,000CM (215 Amps.)	.84"	962	2½"	\$105.00
RH	3/0 (200 Amps.)	.70"	663	2"	
285 AMPERE CIRCUIT					
R	500,000CM	1.09"	1815	3"	\$210.00
RH	300,000CM	.90"	1139	2½"	
380 AMPERE CIRCUIT					
R	700,000CM	1.27"	2512	3½"	\$225.00
RH	500,000CM	1.09"	1815	3"	
400 AMPERE CIRCUIT					
R	750,000CM	1.30"	2673	3½"	\$55.00
RH	600,000CM	1.20"	2177	3½"	

\*These savings are only on copper. Additional savings also result from smaller conduit and fittings; lighter-weight, easier to handle and install wire. Your Hazard representative will be glad to work out an estimate for you of overall savings for a given job.

## HAZARD



insulated wires and cables for every electrical use

7339

**OFTEN COPIED,  
NEVER  
SURPASSED!**

*That's*  
**"UNION"!**

*First* ... to produce the moulded  
Insulated Conduit End Bushing, that  
made Insulated Bushings Preferred!



Inside of lip beveled to remove cutting  
edges—makes wire pulling easy.

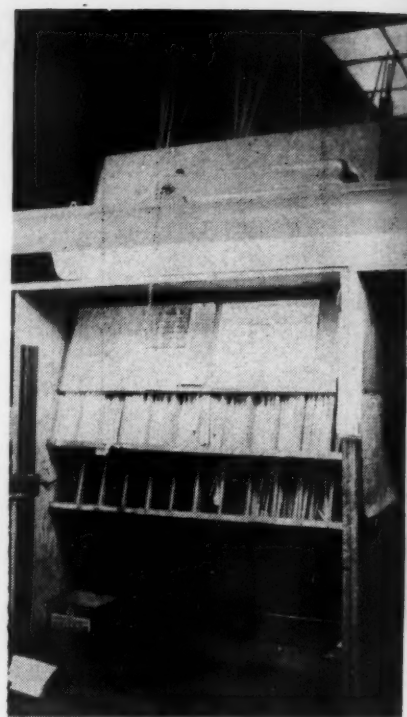
Economically prevent costly grounds and  
short circuits.

*The Increasing Demand for "UNION"  
Bushings is Evidence of their  
Superiority!*

**UNION INSULATING Co., Inc.**  
PARKERSBURG  
WEST VIRGINIA

**"UNION" PRODUCTS**

Weatherproof Pigtail Sockets  
Ever-Ready Pin Type Sockets  
Insulated Conduit End Bushings  
Insulated Entrance Bushings  
Bakelite Outlet Boxes & Covers  
Bakelite Lamp Receptacles  
Hay Mow Lighting Fixtures  
Pull Chain Lampholders



*Front view of slot stick and tubing  
storage rack showing tilted construction  
and access openings to chutes.  
Rack is mounted on bench.*

tom of the chute openings keeps stock  
from spilling out.

The entire rack is tilted back about  
30 degrees off the vertical to provide  
better accessibility and identification  
of stock and to facilitate top loading  
of the chutes. Sabine reports that this  
rack design keeps stick and tubing  
assortments in order by eliminating  
spill-over encountered with parallel  
open troughs; reduces left-over waste  
by keeping short pieces at point where  
mechanic makes selection; utilizes  
wasted overhead space for storage  
purposes.



*Prominent electrical contractors in  
Springfield, Ill., are Frank Musgrove  
(left), Musgrove Electric Service and  
Frank Babiak, Babiak Electric Service.*



● *For Any Grounding Connector —  
open your Penn-Union Catalog*

*—you'll find what you need in the Complete line*

These pictures will give you an idea of the wide variety offered in the Penn-Union Catalog:

Grounding connectors, clamps, and studs for all combinations of pipe, rod, flat bar, braid, tubing.

Every one a thoroughly tested, dependable unit of protection for personnel and equipment . . . of ample capacity, high mechanical strength, and resistant to corrosion.

Penn-Union also makes the *complete* line of Service Connectors, Power Connectors, Tees and Cable Taps, Straight and Parallel Connectors and Reducers, Terminal Lugs, etc.

Penn-Union fittings are the first choice of leading utilities, industrial corporations, electrical manufacturers and contractors — *because of their known dependability.*

*Sold by Leading Wholesalers*

**PENN-UNION ELECTRIC CORPORATION**

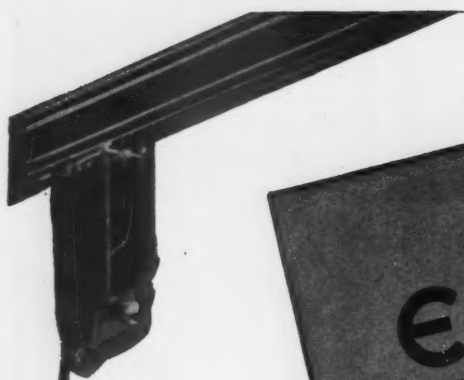
**Erie, Pa.**

Canada: Dominion Cutout Company, Ltd., 250 Richmond St. West, Toronto

THE *Complete* LINE OF CONDUCTOR FITTINGS

**PENN-UNION**





# ELECTRIC FEEDRAIL

THE MODERN ELECTRICAL DISTRIBUTION SYSTEM  
*for*

PORTABLE TOOLS  
CRANES, HOISTS  
MACHINE TOOLS  
CUTTING TABLES  
and  
SEWING MACHINES

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THIS  
NEW  
32-PAGE  
CATALOG  
*is ready  
for you*  
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Catalog  
No. 20

The modern electrical distribution system that makes crane and hoist operations safe and reliable is now available for the smallest hand tools, test lines, lighting, and all kinds of moveable electrical equipment.

This 32 page book contains more than 100 illustrations showing how Feedrail speeds production, saves maintenance costs, and eliminates the principal electrical hazards in all kinds of industries.

Also contains mounting diagrams and complete listing of trolleys, track and accessories. Write for your copy now.

23

## ELECTRIC FEEDRAIL

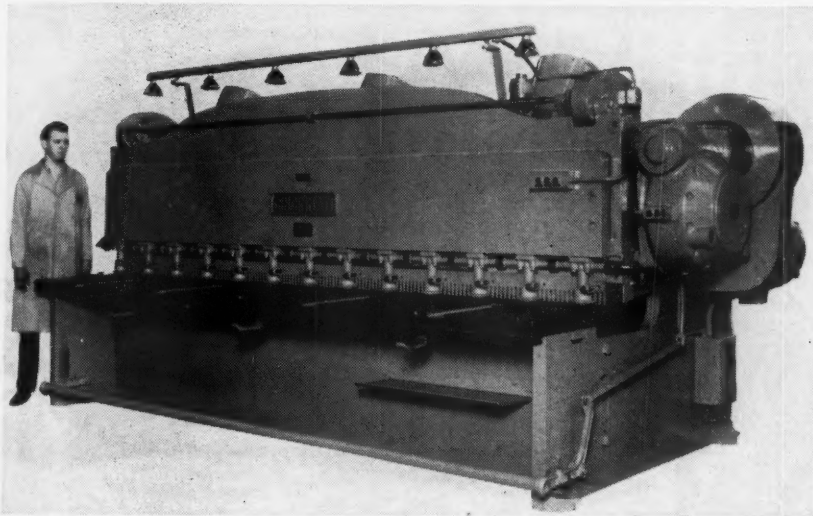
## FEEDRAIL CORPORATION

Subsidiary of Russell & Stoll Company, Inc.

125 BARCLAY STREET • NEW YORK 7, N. Y.

BRIEF ARTICLES about practical methods of installation and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

# Practical Methods



All steel shear having very low rake, made by Cincinnati Shaper Co., Cincinnati, Ohio, is equipped with light beam shearing gauge.

## Improved Lighting For Shear

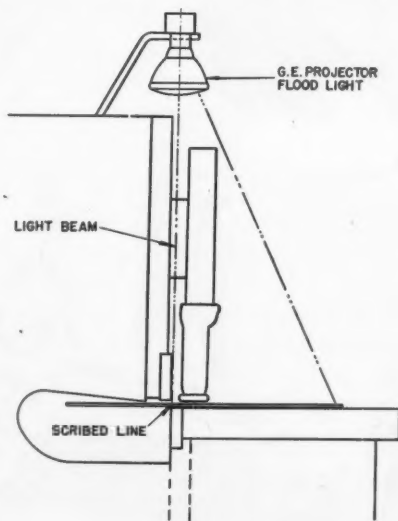
INDUSTRIAL

Many industrial machines are of such design that they present a special lighting problem. The all steel shear is one good example. General lighting from a general overhead diffuse lighting system does not solve the problem of lighting the scribed line on the steel to be sheared.

Recognizing this fact, the Cincinnati Shaper Company of Cincinnati, Ohio, has equipped one of its all steel shears with a shearing gauge lighting unit as standard equipment. This unit provides about ten times as much light on the scribed line as previous methods. It also provides a higher intensity of light over the entire area.

The lighting unit consists of six 150-watt PAR-38 projector flood lamps installed in sockets on 30-inch centers in a standard wiring channel. The wiring channel is mounted on two steel bracket arms, which are bolted to the machine, at a position so that the center line of the lamp axis coincides with the scribed line on the steel to be sheared. (See diagram.) This lighting technique is useful when shearing to a scribed line in the production of gussets and other irregular shapes.

CINCINNATI LIGHT BEAM SHEARING GAUGE



Cross-section detail showing how light beam shearing gauge lights scribed line.

The Cincinnati all steel shear on which the light beam shearing gauge is used also incorporates several other features of interest. It has a capacity of  $\frac{1}{4}$ -inch mild steel twelve feet long, which permits converting sheet stock to strips which are accurate and true for forming, punching, drawing or other operations.

## Airport Runway Darkened by Double Grounds

INSTALLATION

From a Pennsylvania reader comes an interesting letter discussing a recent trouble-shooting wiring problem which occurred at his local airport. Thinking that the experience might contain helpful suggestions for other contractors faced with similar conditions, he dropped us a line with the facts. By inference, the letter stresses the importance of following recommended practices during periods of installation, for care during this particular construction interval would have prevented considerable inconvenience, repair expense and danger to landing planes.

The airport under discussion contains two runways and two taxiways. With the exception of spacing, distribution characteristics of lenses, color, and details of reinforced-concrete base slabs, all strips are lighted by shallow base series marker lights with 6.6-amp. lamps. Current is maintained at this amperage by a constant-current regulator, and all lights are controlled by four circuits (two of which are used for runway and range lights while the remaining two circuits illuminate taxiway strips). Circuits consist of trench lay lead cables, sealed to prevent the penetration of moisture into individual lamp housings. These circuits are energized by magnetic-contactor selector relays, remotely operated from the control tower by two-stage selector switches. Thus, when a remote relay is de-energized, the released contactor acts as a short across the ends of the affected circuit and, with current bypassing this circuit, lights remain inoperative. Conversely, with contactors raised by energized relays, all lights on that circuit will produce rated lumen output.

Shortly after this installation was completed, however, light output of lamps on Runway 1 was materially reduced, although an inspection of the individual housings on this circuit failed to reveal any possible source of trouble.

A further check of the entire instal-

YOU CAN BE **SURE**.. IF IT'S  
**Westinghouse**





# STOP!

## ...have you planned your power distribution system?

Building a new production area? Everything laid out to do the job you've planned? Sure it is.

BUT . . . have you planned for the *best system* to power your new production lines? Their ability to produce depends directly on this power system.

Will your distribution system save you money *over a period of years*? Have you thought about *future* loads? Is it flexible enough to handle shifting production lines?

Will it provide voltage regulation you need?

Whatever the problem—Westinghouse can help you find the "one best" system for *your* plant.

Our engineers have worked with *all types* of industries for a good many years. They have found new and better answers to *all* phases of power distribution. Westinghouse offers this co-operation to all Industry in getting power to do the best job at the lowest possible cost.

J-94788

### Here's REAL help for your "System Planning"

1. A new 34-page booklet: "Industrial Plant Distribution Systems", B-4045. Fact-filled pages and colorful diagrams present the basic systems most widely used in Industry today. Find how to choose the *best system* for *your* plant.

2. System Selector: A wealth of information condensed to a pocket-size selector! In a matter of minutes you can make preliminary decisions on the system that answers *your* requirements.

3. Color Movie: Get all the facts visually! This 16-mm, full-color movie is a 20-minute dramatization that will point the way to new economies in plant power distribution. Ask one of our representatives for a free showing of "The Right Power Distribution System". No obligation, of course.

*If you're expanding or building a new production area . . .  
get this invaluable information NOW!*

Call your nearest Westinghouse office, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

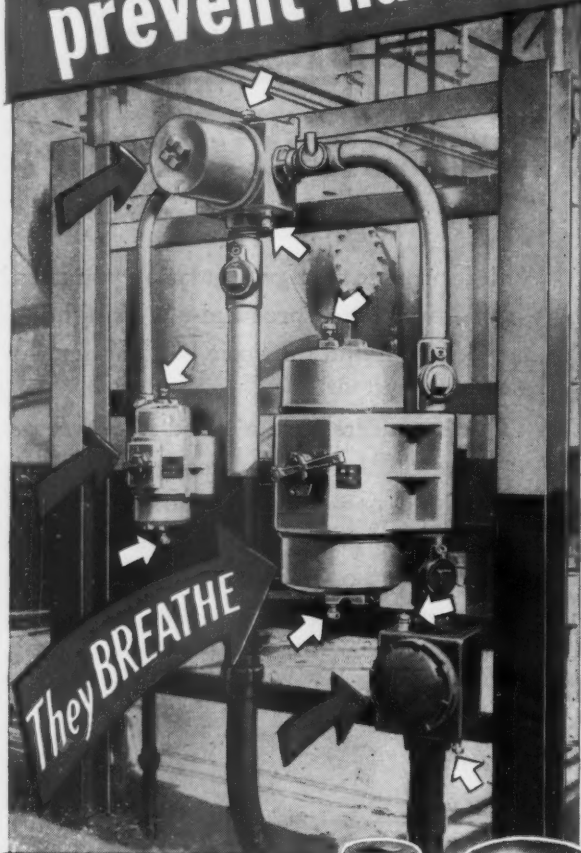


**Westinghouse**  
SYSTEM PLANNING SERVICE



# CROUSE-HINDS Breathers

prevent harmful water condensation  
In explosion-proof  
electrical conduit systems  
under humid conditions



- ▶ **FORESTALL** the formation of destructive mildew by ventilating enclosures.
- ▶ **EXTEND** the **LIFE** of insulation and equipment under adverse conditions.
- ▶ **MINIMIZE** the danger of expensive shut-downs due to insulation or equipment failure.

Paragraph 5015-C5 of the 1947 National Electrical Code states that "where there is a possibility that water or other condensed vapor may be trapped at any point in the raceway system, approved means shall be provided to prevent accumulation, or to permit periodic draining of such water or condensed vapor"

Explosion-proof electrical enclosures cannot be vented in any of the usual ways because they must be kept flame-tight. Crouse-Hinds' explosion-proof Type ECD Breathers, Type ECD Drains, and Type EZD Drain Sealing Condulets meet the Code requirements and are listed by Underwriters Laboratories for such service.

The Breathers are similar to the Drains but have metal hoods which make them water and dust shedding. Both have corrosion-resisting bodies with internal flame-tight (but not airtight or watertight) labyrinths. They can be used freely without impairing the explosion-proof integrity of a conduit system, providing they are always installed in a Condulet hub or other opening with five or more full threads engaged.

In humid atmospheres, water condensation occurs in explosion-proof systems, especially where temperature changes are frequent. Accumulation of water in harmful quantities is common. Mildew, a bacterial growth, is often present. It attacks many insulations and will destroy them unless the cause is removed. In such humid atmospheres troubles of this nature can be avoided by the proper installation of Crouse-Hinds' Breathers and Drains in conjunction with explosion-proof Condulets\*.

Breathers should be placed at the highest points and Drains at the lowest points of all housings and conduit runs. Heat generated by the current flowing through conductors and electrical devices raises the temperature of air within the conduit and housings. Breathers and Drains permit the resultant upward passage of the warmed air to remove moisture and thoroughly ventilate the enclosures. This prevents the accumulation of water and removes moisture that may have collected under unusual conditions.

This method is successfully used in many of the largest plants in the chemical and petroleum industries. Several years of field experience has demonstrated that the moisture is either entirely removed by ventilation, or so reduced that it is not harmful.

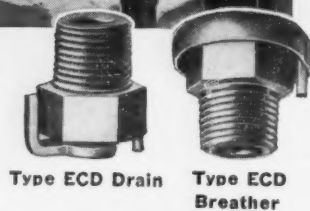
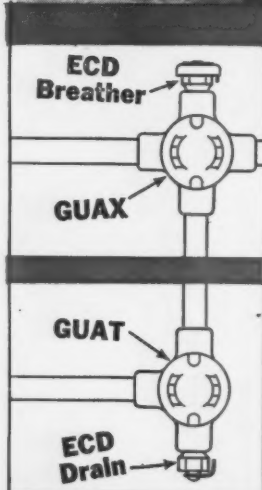
These devices have also been successfully used in non-hazardous locations where condensation is troublesome.

If you have a condensation problem, Crouse-Hinds Company will gladly assist in solving it. Write to

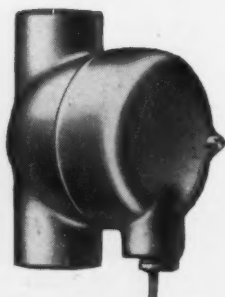
## CROUSE-HINDS COMPANY Syracuse 1, N. Y.

Offices: Birmingham—Boston—Buffalo—Chicago—Cincinnati—Cleveland—Dallas—Denver—Detroit—Houston—Indianapolis—Kansas City—Los Angeles—Milwaukee—Minneapolis—New York—Philadelphia—Pittsburgh—Portland, Ore.—San Francisco—Seattle—St. Louis—Washington.  
Resident Representatives: Albany—Atlanta—Baltimore—Charlotte—New Orleans—Richmond, Va.  
CROUSE-HINDS COMPANY OF CANADA, LTD., Main Office and Plant: TORONTO, ONT.

\* CONDULETS are made only by CROUSE-HINDS



**CONDULETS** with Crouse-Hinds Breathers and Drains can be installed for ventilation throughout an entire explosion-proof conduit system

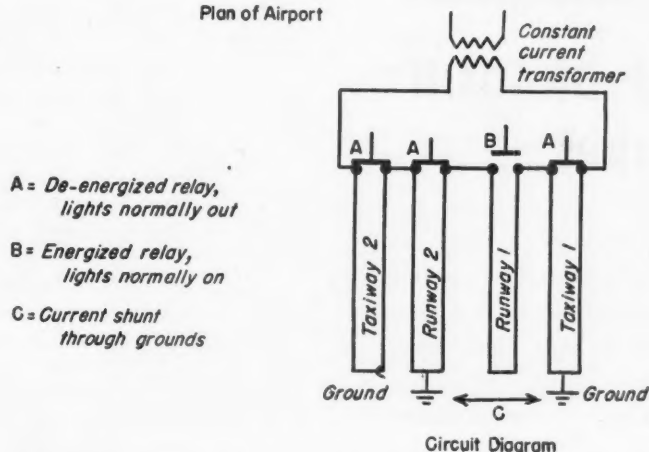
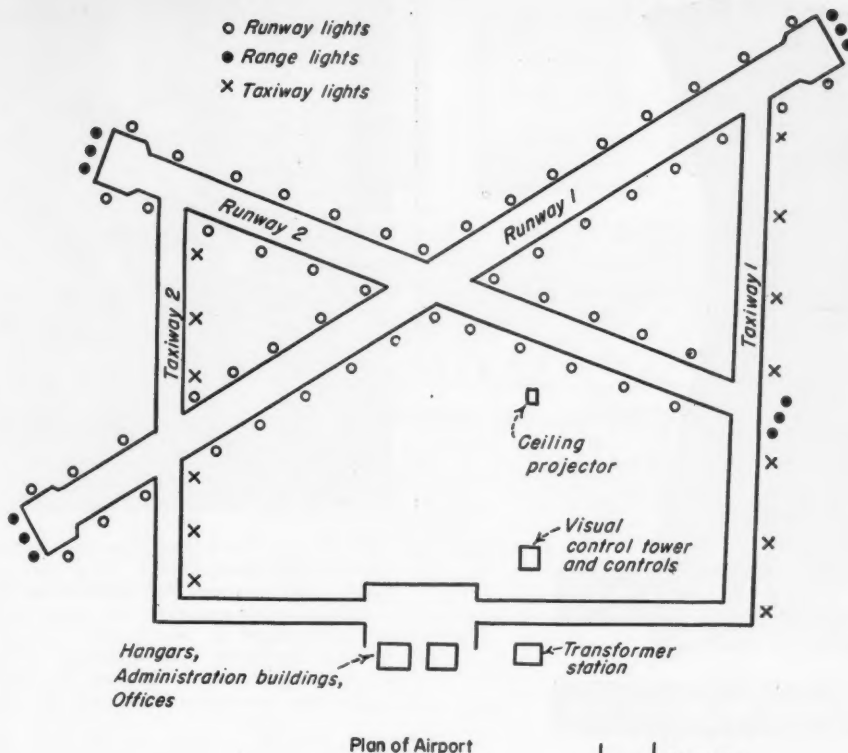


**Type EZD Explosion-Proof  
Drain Sealing Condulet**

A  
Nationwide  
Distribution  
Through Electrical  
Wholesalers



**CONDULETS · TRAFFIC SIGNALS · AIRPORT LIGHTING · FLOODLIGHTS**



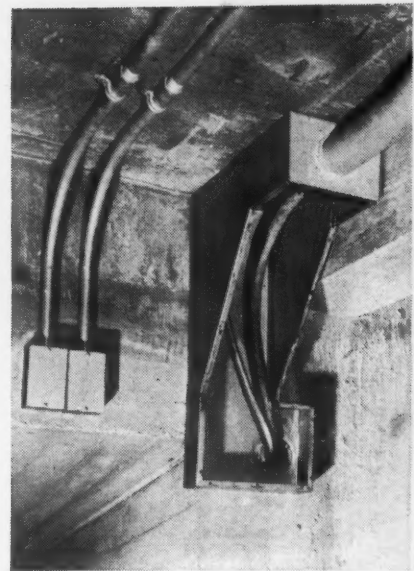
Plan of local airport indicates relative positions of runways and taxi strips, control tower containing selector controls for runway and taxiway lights transformer station and structures located beside taxiway apron. Circuit diagram indicates position of magnetic-contactor selector relays when only Runway 1 is lighted. Current shunt, created by grounds in circuits for Runway 2 and Taxiway 1, reduces amperage and lumen output of lights in circuit for Runway 1.

lation finally indicated that there were two grounded housings on other circuits, due to unsatisfactory lead seals and the resultant infiltration of water. These two grounds, one in Runway 2 circuit and the other in a Taxiway circuit, resulted in a current shut past the Runway 1 line. This was verified by meter readings which showed that only 2.3-amps. were passing through the affected circuit, while 4.3-amps, were passing through the ground shunt.

Positive location of the grounds was determined by checking each circuit individually; isolating the other circuits and energizing only one side of the circuit remaining in use. In this manner, the locations were quickly

spotted, for lamps on the circuit between the source of energy and the grounded housing remained at full brilliance while lamps beyond this point either dimmed or remained unlighted.

To all appearances, this job had been installed in accordance with all official and unofficial recommendations. It had been officially inspected and approved. But the conditions of fault, so minor as to escape detection, had resulted in a waste in both time and effort. Since grounds such as this can result in darkened runways during bad weather, they also constitute a flying hazard—which could be minimized by insisting on prescribed sealing methods.



Triple-offset pull box carries telephone cables from concealed duct in underground tunnel to exposed raceway at the Chicago plant of the Liquid Carbonic Corporation. Box design facilitates pulling; providing for wide sweep of lead sheathed cables.

## Simplified Tool Check System

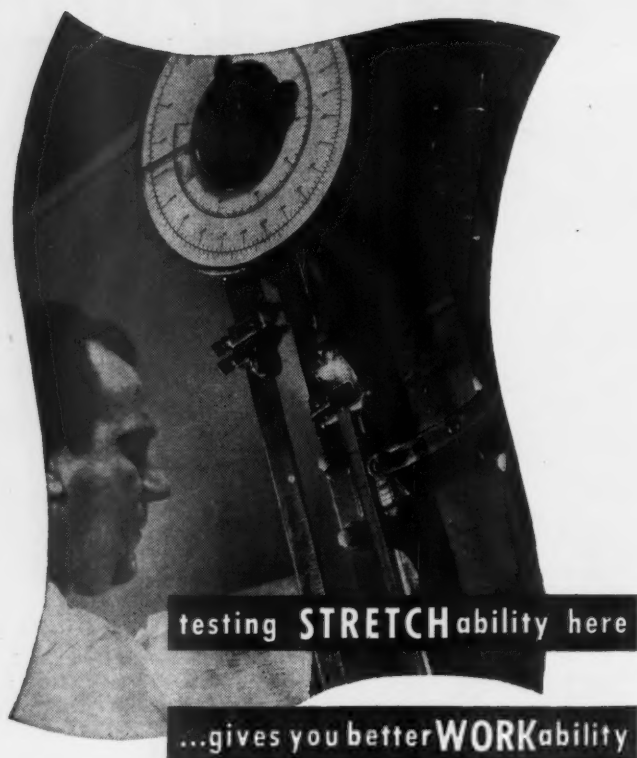
SHOP ORGANIZATION

Every contractor knows that tools have a habit of "walking" off the job, or even out of the shop tool room. Much of this can be attributed to a shift of tools from one job to another, or from one mechanic to another, without keeping records of such transfers. Memory cannot be trusted as an inventory file, particularly where numerous jobs are in operation at the same time. Tracing lost tools usually involves considerable time, effort and money. Those items that never do show up are usually charged off as an additional operating expense, or, if the project can stand it, as a direct job expense. No one is happy when that occurs.

The D. H. Kehne Electric Company, St. Paul, Minn., electrical construction firm, reduced this possibility to a practicable minimum by developing a check system that combines tool requisition and daily inventory in a single scheme. Responsibility for tools taken out of the stockroom rests with the man who requisitions them. They are charged directly to him on a visual check board and he must return the tool to secure credit for his time at the end of the day.

Heart of the system is a series of metal-bound, round, colored pasteboard tags, one for each item in the complete tool inventory. Color-coded tags are used to identify the following tool categories:





## in PANTHER and DRAGON Rubber Tapes

Testing the tape's stretchability on a Scott tester, as shown here, is only one of a series of quality control tests made during various stages of production that make PANTHER and DRAGON Rubber Tapes "tops in tapes". You can count on these tapes to be strong enough to stretch without breaking . . . make better splices that will last longer.

Made by a company in the insulation business for nearly 70 years, PANTHER and DRAGON Friction and Rubber Tapes pass ASTM and federal specifications for electrical and physical properties with a wide margin of safety. They have proved their worth in successful splicing jobs of all kinds. Sold only

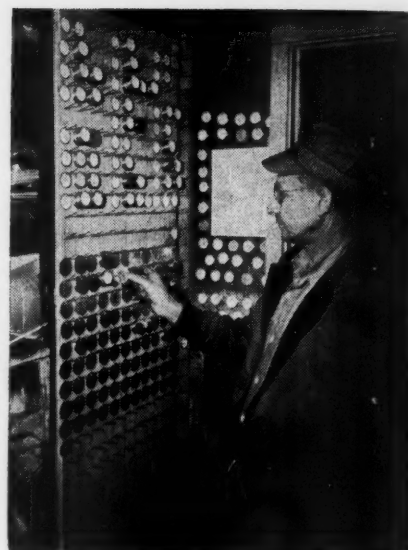
through recognized independent wholesalers The Okonite Company, Passaic, New Jersey



6173

# Panther and Dragon

friction and rubber tapes



*Master tool check board in the Kehne Electric Company shop. Top half of board has tool-tags for equipment assigned to large projects; the lower half for tools used by mechanics working out of the shop headquarters. Note how tool checks are placed on hook under the mechanics brass number tag.*

Red—Power Tools and Meters—including such items as electric drills, electric hammers, small saws, hydraulic benders and pipe pushers, power cutting and threading units, etc.

Green—Line Tools—including such items as gang tool boxes, pipe cutting machines, boring machines, digging tools, etc.

Yellow—Cable Pulling Tools—including such items as chain hoists, block and tackle, reel rollers, jacks, rope, fish tape, etc.

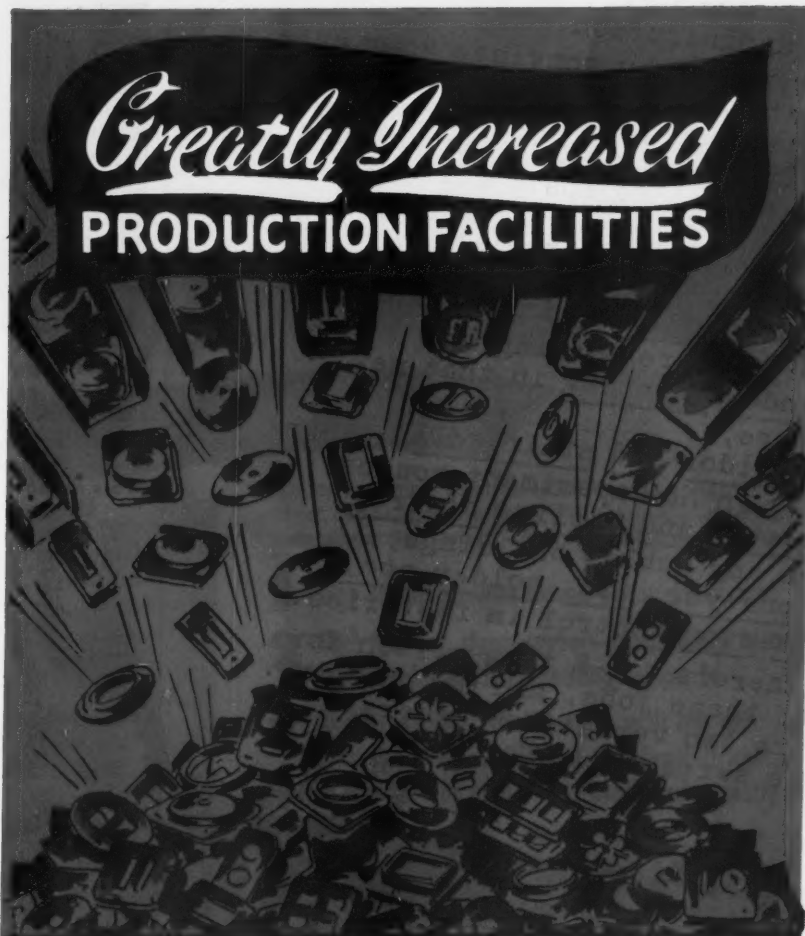
White—Miscellaneous Group—including all smaller tools such as hand cutting units, stocks and dies, wrenches and all the other items in the inventory.

Printed on each tag is pertinent information identifying the tool it represents. Tags (one for each piece of equipment) are mounted on finishing-nail hooks adjacent to groups of tools on the tool crib shelves. Each time a tool is requisitioned, its corresponding tag is transferred from the shelf to a visual check-board mounted just inside the door of the tool crib. Here, each mechanic's brass number tag is mounted on a separate hook. Tags for tools a mechanic has requisitioned are placed on the hook under his "number." To retrieve his number, which he must turn in to the timekeeper to get credit for his time, an electrician must return a tool for each tool-tag on his hook at the end of the day. The tools, and their corresponding tags, are then returned to the crib shelves.

This system is used in the shop tool-room as well as in all field offices at job sites. The only difference is that



*Greatly Increased*  
**PRODUCTION FACILITIES**



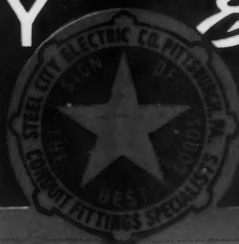
*Plus* increasing supply of high  
quality materials, NOW  
make possible the **complete line of . . .**

**STEEL CITY COVERS**

for all types and sizes of Outlet, Utility and Gang Boxes

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# AN OPEN LETTER

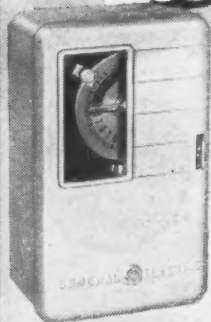
To: Electrical Contractors  
 Subject: G-E Time Switches  
 Purpose: To help you make greater profits and give more customer satisfaction

Every time you convince your customers that G-E time switches are needed for a particular job, both of you benefit—profit for yourself, convenience and lower operating costs for your customer.

Have you considered all these possibilities?

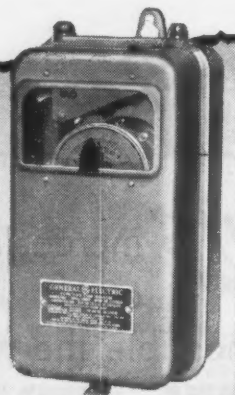
- safety lighting in that new factory you're working on,
- window lighting in that new store,
- corridor and stair-well lighting in new apartment houses,
- heater and cooling control in any public buildings,
- conveyor, fan, solder-pot, or oven control in factories.

There's a G-E time switch for each of these jobs, and many others. Here are two versatile, general-purpose switches:



T-47 handy time switch—repeats on-off cycle (minimum on 5 min., maximum 22 hrs.) every 24 hours. Only \$12.45 list.

Type T-27, the "complete" time switch. It's easily adjusted for any daily schedule. Also available with astronomic dial and omitting device. Prices from \$25.50 list.

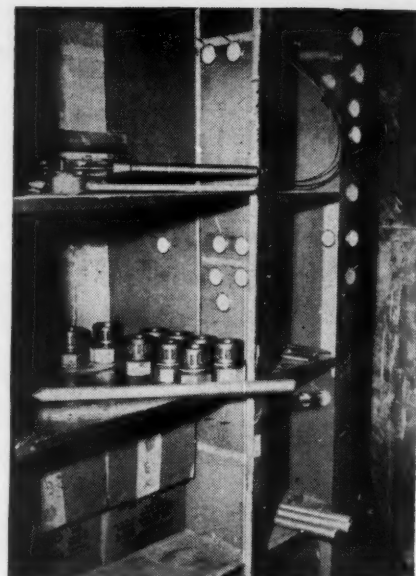


**LONG-RANGE CUSTOMER SATISFACTION** assured by large silver contacts and reliable Telechron® motors in both these switches.

**INSTALLATION MADE EASY** by roomy wiring space and simple knockouts.

For more information on your particular application of these, or any other G-E time switches, see your dealer or nearby G-E sales engineer. Write today for Bulletin GEA-3339 (T-27), GEA-4874 (T-47). Apparatus Department, General Electric Company, Schenectady 5, New York.

**GENERAL ELECTRIC**



Round tags, one for each tool, are hung in each compartment of tool shelves. When tool is removed, corresponding tag is transferred to check board and placed under mechanic's brass number tag.

the shop check-board is necessarily larger and contains a section for "project tools". The upper half of the board contains no mechanic's brass tags, only tool tags. The first tag in each horizontal row identifies the job; tags on adjacent hooks in that row record the tools assigned to the job. The lower half of the board is used for tools assigned to mechanics working out of the shop and contains the brass number tags, similar to the field tool-crib check-boards.

Kehne Electric superintendents report that the system works well. Electricians are less prone to misplace or leave tools out on the job when quitting time comes. Also, it provides a quick daily visual inventory of tool equipment both in the job offices and shop headquarters. To insure against tool mixups with other trades on the project, the Kehne firm paints all its tool equipment red and yellow.

## Parallel Clamps Space Conductors

WIRING

Power supply to the new Alcoa plant in Davenport, Iowa, consists of two 13.8 kv. circuits tied together at the remote end to form a "loop" service. The two sides of the loop are carried vertically on opposite sides of steel towers. Each side consists of three phases with two parallel 1,033,500CM stranded aluminum conductors per phase.

To prevent the parallel conductors from rubbing together in the wind,



# What makes a good tape *GOOD?*



## MEMO FOR CONTRACTORS!

### THE HANDY 10-ROLL PROTECTIVE CONTAINER

Keeps tape clean and fresh on the job. It's a good idea to have a few always on hand in your field stock-room, ready for use when you need it.



To manufacture good serviceable tape certain standards must be met. A short cut on any one point would result in a sub-standard product. Accurate production strictly adheres to the 5 quality points below—at all times.

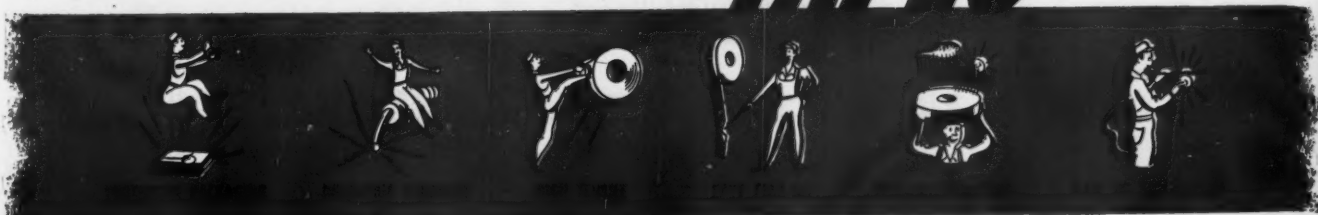
- 1** Fine strong straight woven cotton fabric base.
- 2** High quality, clean rubbers scientifically blended to form a stable, tacky, adhesive impregnating compound.
- 3** Impregnation of the sheeting with the compound by steel calendar rolls operating at different peripheral (friction) speeds. That's where friction tape gets its name. Tape made by less costly methods isn't genuine friction tape.
- 4** Slitting to desired width on specially designed machines to assure clean, non-raveling edges.
- 5** Proper packaging in handy protective cartons and tins to keep tape clean.

That's the way ACCURATE Friction Tape is made. It's the reason every foot is of consistently high quality. Friction or rubber, use ACCURATE Tapes for best results because all are made to highest standards for your protection. There is an ACCURATE distributor near you. Ask for his name today. Just write Accurate Mfg. Company, Garfield, New Jersey.

# ACCURATE

25 YEARS MAKING TAPES EXCLUSIVELY

# TAPES





*Introducing...*

## JOE RAMSETTER!

If you don't know JOE RAMSETTER, you're missing a profit-maker. Joe carries the sharpest pencil you ever saw, for cutting costs and saving time on fastening jobs in steel, concrete, brick, other hard materials. It's the RAMSET FASTENING SYSTEM.

No chipping! No drilling! No plugging! Not for Joe! In 30 seconds, he prepares the tool, then places it against the work, taps it—and RAM! It instantly sets pins and threaded studs up to 6" long and  $\frac{5}{8}$ " diameter. It's fast, it's tight, it's as economical as reading a newspaper over a neighbor's shoulder.

Five pounds of RAMSET TOOL do the trick. Self-contained, completely portable. Easy to use. In 30 minutes, we teach any good, careful workman to RAMSET up to 50 fastenings per hour.

RAMSET SYSTEM saves so much time and money you won't believe it until you see it. Better send for Joe to demonstrate on your own jobs. Just mail the coupon.

**Ramset**  
FASTENING SYSTEM

Stemco Corporation,  
Cleveland 16 (Rocky  
River), Ohio.

Stemco Corporation,  
Cleveland 16 (Rocky River), Ohio  
Please have JOE RAMSETTER show us how to  
save time and costs on fastening jobs.

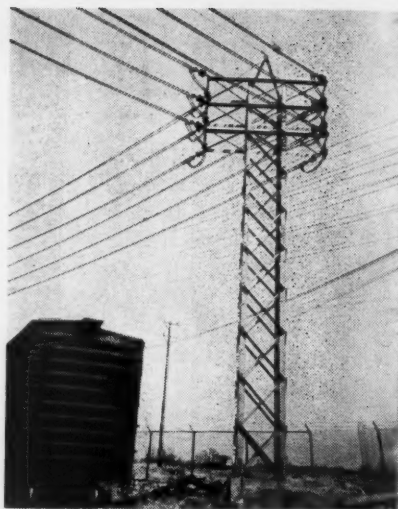
Name \_\_\_\_\_

Company \_\_\_\_\_

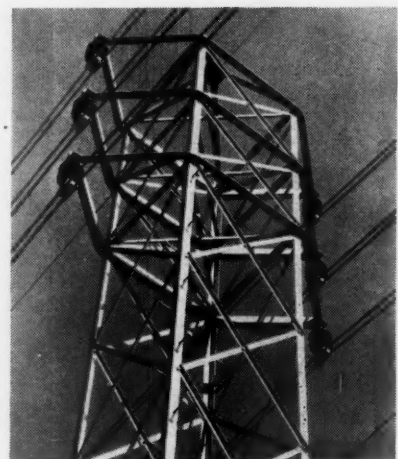
Address \_\_\_\_\_

MAIL THIS COUPON

EC-3



Typical construction on corner tower showing dual dead-end lugs with tie-loop on each phase.



Closeup of parallel groove clamp suspension of 13.8 kv. loop service to Alcoa Davenport plant.

separator clamps were used to keep the cables about three inches apart at and between tower supports. Standard, 6-inch, 3-bolt, aluminum parallel groove clamps were cut in half and drilled for two-bolt mounting. Four clamps were used for each 120-foot span. Suspension insulators at the towers were equipped with similar clamps.

At dead-end points on corner towers, or where substations occur, special compression-type dual lugs with tie-loop or take-off offsets were used. Tie-loops at corner locations are also suspended from tower steel by parallel groove clamps on suspension insulators. The system was designed by Alcoa engineers and installed by Fischbach and Moore, Inc., electrical contractors on the project.

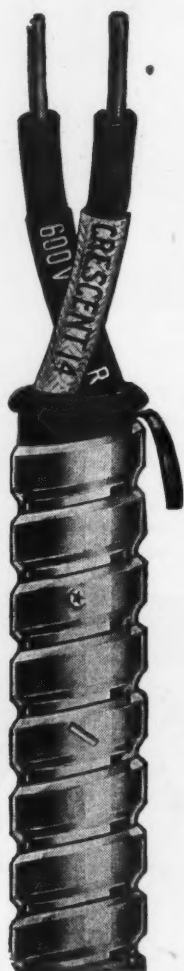
The system as installed has elicited favorable comments from operating personnel, management and supervisory men in the plant and it is apparent that the installation insures both safety and efficiency.

# CRESCENT

## A B C ARMORED CABLE

Has These Improved Features  
Which Make Installation

**EASIER—QUICKER—SAFER**



### Bond Strip Under Armor

← Permanently low armor resistance is provided in sizes No. 14 and 12 AWG by use of a flattened, bonding wire which is in contact with the under side of each convolution.

### Prefabricated Break Lines

← The Cut Mark (at 1½" intervals) shows the location of a prefabricated breaking line inside the armor. Only a few strokes of a file or saw guided by the Cut Mark are required to cut through one outer ridge, and a bend by hand severs the armor. This results in a clean separation with no sharp edge—a safer, easier and faster job. The prefabricated breaking lines are so designed that there is *no reduction* in tensile strength, bending quality, crushing resistance and electrical conductivity of armor.

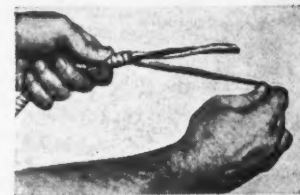
*In the last 20 years alone, over SIX BILLION FEET of Armored Cable have been produced by the industry. Armored Cable provides the only general purpose, factory-assembled and tested, metal protected wiring system.*



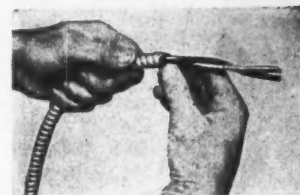
FILE OR SAW



BREAK



PULL OUT PAPER



INSERT BUSHING



## CRESCENT WIRE & CABLE

CRESCENT INSULATED WIRE & CABLE CO.  
TRENTON, N. J.





# Remote Control System Offers Increased Share Of Construction Dollar

## General Electric Remote Control Wiring System Promotes Expanded Use of Contractor's Services In Buildings of All Types

With the announcement of General Electric remote control wiring, structures of all kinds become expanded markets for wiring work. Because this new system now makes multi-switch wiring practical and economical for widespread use, it provides electrical contractors everywhere with a workable tool for "selling in" complete switch control on every wiring job.

Designed to fit in with existing installation techniques, the General Electric remote control system makes no change in materials and methods required for installing power circuits. The simple switching circuit is the only part of the system that presents a new installation idea. This circuit consists of a relay, a transformer, lightweight (number 18) wire, and the new, attractive remote control switch. Switches can be wired into the relay from many locations at various distances from the relay. "Easy as wiring a doorbell," was the way one observer described this part of the installation.

### Adds Extra Value

General Electric remote control represents an attractive investment to everyone interested in building—from the prospective small-home owner to the man who is investing in large-scale building. The convenience this system offers, and the extra value it gives to any type of construction, make it a "must" for any individual who is concerned

about the workability and the future of his investment. Because of these positive values, the contractor will find a ready market among foresighted investors for the additional materials and services involved in remote control wiring.

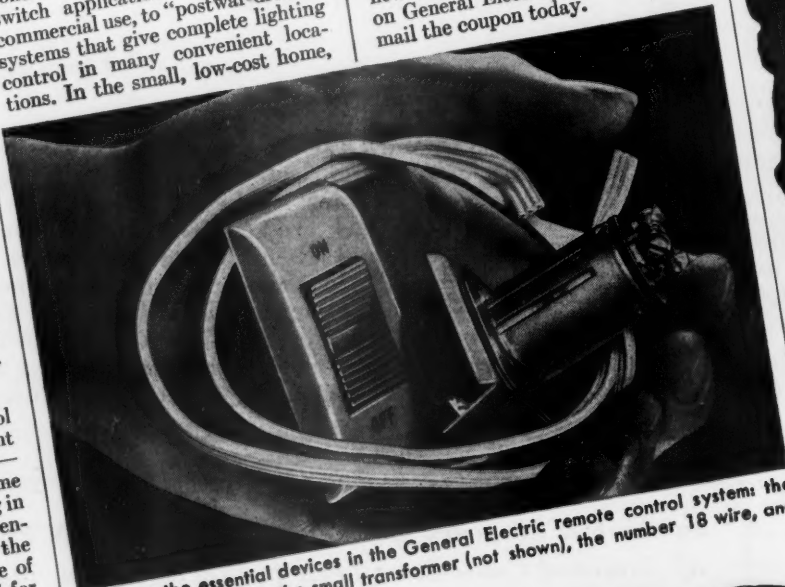
### Has Widespread Uses

The conveniences now made possible by General Electric remote control range from simple multi-switch applications for home and commercial use, to "postwar-dream" systems that give complete lighting control in many convenient locations. In the small, low-cost home,

a simple system can be installed to give control of cellar lights from any floor in the house. In the more expensive unit, the system can be used to give control of attic fans, radios, yard lights, and bathroom heaters from various locations. Switches can even be installed at convenient chairside spots for complete "dream-home" lighting ease. For commercial and industrial buildings, there are unusual possibilities for local and centralized control of lights in various locations.

### Increases Business

To the electrical contractor, General Electric remote control offers an exciting opportunity for broadening his services on every job he does. Everyone in the contracting field owes it to himself to investigate this new wiring system. For information on General Electric remote control, mail the coupon today.



Here are the essential devices in the General Electric remote control system: the new, attractive switch, the small transformer (not shown), the number 18 wire, and the relay.

**Get ready  
Mail Coupon today!**

Section D29-318

General Electric Company, Bridgeport 2, Connecticut

Please send me your new booklet on the General Electric remote control wiring system.

NAME \_\_\_\_\_ TITLE \_\_\_\_\_

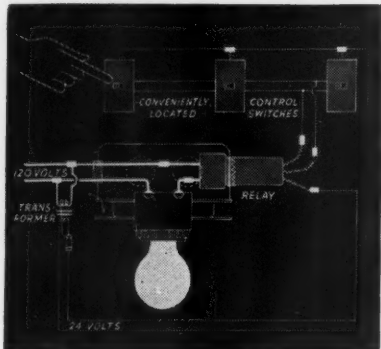
COMPANY \_\_\_\_\_

STREET \_\_\_\_\_

CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

GENERAL  ELECTRIC

# Equipment News



## Low Voltage Control System

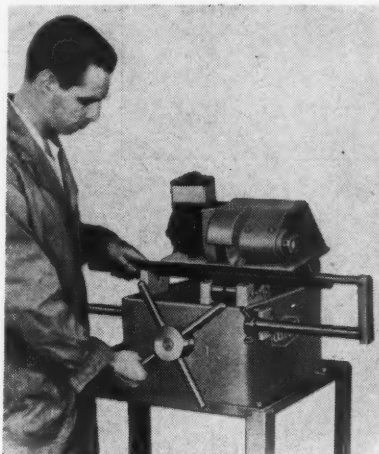
This new low voltage control system permits "adequate switching" of lights. Small, remote control relays which handle the load can be installed in a knockout of the nearest outlet box. Individual relays are controlled by any number of conveniently located switches operating on a 24 volt system. One relay can be operated from any number of control switches located at several convenient points, or several relays can be operated from one point by means of either manually or motor operated master switches. Any number of control stations can be operated in parallel. Master systems permit control of selected lights from a single point, or the switching "on" or "off" of either all or a certain group of lights from a master control station. Square D Company, 6060 Rivard Street, Detroit 11, Mich.

## Motor

A new, explosion-proof, single phase, type KC, capacitor-start fractional hp. motor for gasoline vending pumps has been announced. Designed for horizontal mounting, it is available in ratings of  $\frac{1}{2}$  hp. 1725 rpm., 60 cycle, and  $\frac{1}{4}$  hp., 1425 rpm. 50, 25 cycle, 115/230 volts a-c. Motor is suitable for use in Class I, Group D hazardous locations. Built-in features are an automatic reset overload protective device, voltage selector switch and on-off line switch. External leads are 36 inches long. A swivel conduit connector, with close fitting threads, protects the lead outlet and is adjustable. Motor also available for 115 volt and 230 volt d-c operation with modifications in base and end shield design. General Electric Company, Schenectady 5, N. Y.

## Magnetic Contactors

New Bulletin 4454 size 4 and Bulletin 4455 size 5 a-c magnetic contactors for motor, heater and lamp control purposes has been developed. Some of the features incorporated on these 150 and 300 amp. contactors are: movable and stationary contacts on both sizes are identical and interchangeable; removable cold molded arc shields for all main poles; new magnetic circuit permitting positive operation over a wide range; accessible solderless clamp type connectors for line and load terminals; standardized mounting panels. Size 4 contactors are available with a maximum of five main poles and size 5 with two or three poles only. Both sizes can be supplied with open type construction or with NEMA Type I enclosures. Coils permit operation on various frequencies. Ward Leonard Electric Co., Mount Vernon, N. Y.



## Pipe Cutting Machine

Known as the No. 662 "Cut Master", this machine is designed for cutting off small or large quantities of pipe within the range of  $\frac{1}{4}$  in. to 2 in. Motor is  $\frac{1}{2}$  hp., 10,000 rpm. universal, variable speed, geared head type for light socket operation. Gear ratio is 29.25 to 1. Motor, idler shaft and cutter shaft are mounted as a unit on a plate hinged to the base casting. Rollers supporting pipe to be cut off are mounted on needle bearings. The Oster Manufacturing Company, 2057 East 61st Street, Cleveland 3, Ohio.



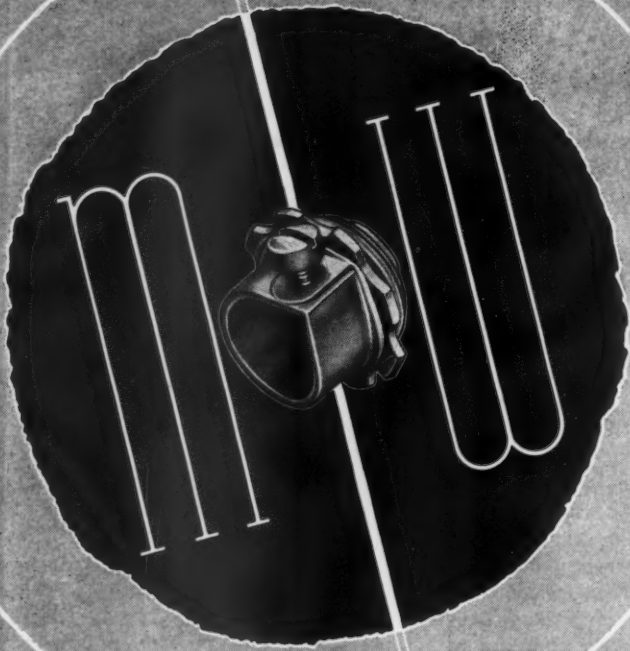
## Lighting Control

A new single unit outdoor lighting control for interval night illumination is now available. Series 62405 photoelectric relay may be used for transportation terminals, freight loading areas, parking lots, signs, billboards, display windows, rural street lighting, factory yards. Unit consists of a light sensitive photorelay and a built-in-time-switch. The photorelay turns on the lights at a preset value of daylight, and the automatic time switch turns them off at any preset time during the night. The time switch can also be set to turn on the illumination early in the morning if desired. Model 62405 operates on 115 volt a-c, Model 62406 on 230 volt a-c. Fisher-Pierce Company, 45 Ceylon Street, Boston, Mass.

## Banding Lathe

A new banding lathe for applying and rolling bands on Diesel electric traction motor and generator rotors has been announced. It has a 40 inch swing diameter and 60 inch length from face plate to tailstock live-center. Banding wire is drawn from the supply spool mounted on the de-reeler spindle, extending from the rear of the headstock, with suitable preliminary tensioning mechanism and permanently threaded over takeup pulley, is fed onto rotor by carriage traversed by handwheels. Rotor may be driven at a selected speed of from 15 to 60 rpm. and control of machine is accessible from either side. Globe Tool & Engineering Co., 422 Davis Ave., Dayton 3, Ohio.





*Fittings for*

• thinwall conduit • rigid conduit • metallic and non-metallic cable • flexible steel conduit • service entrance cable • grounding devices • lighting fixture fittings

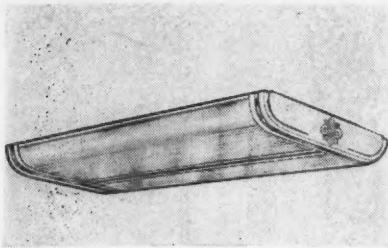
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midwest





### Fluorescent Fixture

A newly developed plastic shielded fluorescent lighting fixture for residential and commercial use has been announced. Finished in white enamel with chrome trim, these shallow units give a soft, diffused light. It features opal fluted plastic. Made for two, three and four light 20 watt lamps and two 40 watt lamps. Shielded enclosure is easily removed for servicing. Key-tone Electric Mfg. Co. 2228-36 E. Tioga St., Philadelphia 34, Pa.

### Solderless Connectors

A complete new line of solderless electric connectors, featuring serrated, silver contact surfaces, interlocking sides, has been announced. The serrated contact surfaces give high pull-out strength, positive pressure on the cable, resistance to vibration and a high-conductivity joint. Connectors can be installed without removing nuts from the clamps. Some of the types are straight, tee, block terminal, angle, parallel, ground, in both Class A-1 and A-2. Also available are expansion bends, busbar clamps, and live-line disconnecting clamps. General Electric Co., Schenectady 5, N. Y.

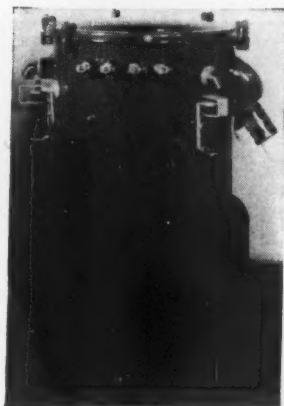
### Air Conditioner

Designed in a two-tone, mar-resistant, brown finish, this new console type room air conditioner, known as 51H2 DeLuxe, is for use in both offices and home. Unit has one hp. capacity. It has a special exhaust control for removal of stale air and smoke, and a two-speed fan for draftless air distribution. Refrigerating compressor and motor are hermetically sealed. Control panel, concealed behind hinged cover on front of cabinet, consists of two knobs. One turns on fan only, and the other is a selector which controls fan operation at high or low speed for ventilation, or can be turned to reverse fan rotation to exhaust smoke to the outside. Space is provided in center of panel for a

thermostatic control knob for automatic operation. Union operates on 230 or 208 volt, single phase, 60 cycle. Cabinet dimensions are 40 inches high, 34 inches wide, and 21 inches deep. Carrier Corporation, Syracuse, N. Y.

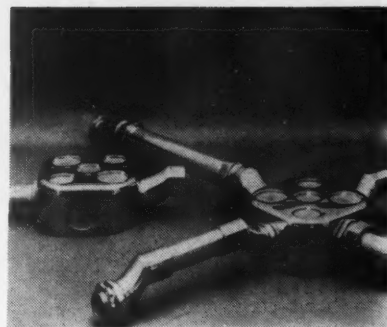
### Bender

This Form-Bar bender has been designed to make "cold bends" on the job. This tool will handle copper, aluminum, brass and mild steel bar or strip through a complete range of sizes  $\frac{1}{8}$  in. to  $\frac{1}{2}$  in. in thickness and up to 6 in. in width. The bender is portable and simple to operate in making bends up, down, sideways and twists. Short offsets and "Z" bends can also be made and a positive set-up for repeated "pre-fab" duplicate bending is included. A vertical mounting position makes the tool flexible for handling. Winfield R. Scott, 234 South 11th Street, Newark 7, N. J.



### Transformers

A line of CSP three-phase distribution transformers for small industrial or commercial loads has been announced. Incorporating all the protective features of the CSP single-phase transformer, new units have built-in De-ion lightning arresters, three mechanically interlocked, heavy-duty circuit breakers on the secondary side as safeguards against overloads and short circuits, and primary protective links for system protection. Available in sizes of 9, 15, 30, 45 and 75 kva. for primary voltages of 2400 to 14,400 incl. and with secondary voltages of 208Y/120, 240 delta by 480 delta for the primary classification. They are equipped for pole mounting or can be mounted on platforms or mats as required. Westinghouse Electric Corp., Pittsburgh 30, Pa.



### Connector

A new offset electrical connector for use in electrical wiring has been developed. Known as Amadco Adapter, it provides curved conduits for wiring entering or leaving boxes, switches, etc. It eliminates need for bending wall conduit pipe. Three types are available, fitting all standard conduit sizes, plus a gutter offset. Langman Industries, 3320 S. E. 50th Ave., Portland, Ore.

### Snap Switch

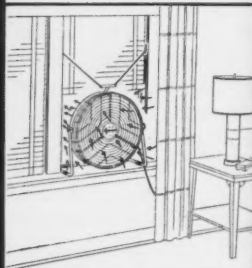
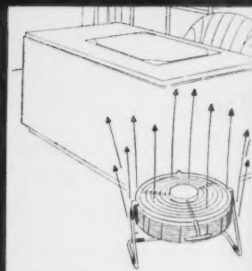
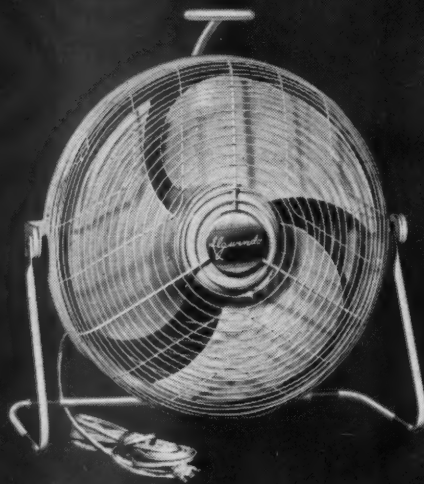
The ESCO type "P" rotary snap switches are now available in explosionproof, dust-tight, vapor-tight, weatherproof housings for hazardous locations. The assembly may be surface mounted with switch handle on dome, or can be furnished with switch shaft inverted and projecting through base for panel mounting. Standard conduit connections are provided— $\frac{3}{4}$  in. for the shallow case and 1 in. for the deep case. Style 30H is rated at 30 amps., 500 volts a-c, 250 volts d-c. Style 10H is for surface mounting only, and is a 10 amp. 1250 volt, a-c switch. Circuit combinations for both styles are 4PST or DPDT for the shallow type and 8PST or 4PDT for the deep type. Electro Switch Corp., Weymouth 88, Mass.

### Threading Machine

Model B is a portable power tool to thread  $\frac{1}{8}$  in. to 2 in. pipe,  $\frac{1}{4}$  in. to  $1\frac{1}{2}$  in. bolts, and with drive shaft and geared tools it will thread up to 8 in. pipe. It operates with a universal a-c or d-c motor of 110 or 220 volts, 25 to 60 cycle. It has an automatic switch lock and chuck wrench holder. Other features are quick-opening, fully-adjustable, ring-type dieheads; ball bearing, self-centering wheel-and-roller cutoff; motor with reversible switch; right-hand operation; rack-and-pinion feed; all gears enclosed; oil level indicator in gear case. Beaver Pipe Tools, Inc., 1001 Dana Avenue, Warren, Ohio.

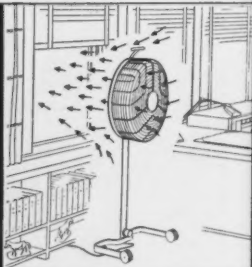


# New for '49!



## Ilgdualaire

Double purpose fan. Secured with chain in window for night cooling. Pivots on stand to serve as circulating fan. New "Q" wheel for extremely high efficiency and quiet operation. Ready for volume sales.



## Ilgrollaire

A beautiful, new, portable fan—and it's budget priced! Lightweight—easily rolled to window or storage closet. Adjustable height. Two speed. Remarkably quiet. Huge capacity. Nationally advertised.

**ILG ELECTRIC VENTILATING CO., 2879 No. Crawford Avenue, Chicago 41, Illinois. Offices in more than 40 Principal Cities—consult classified directory.**

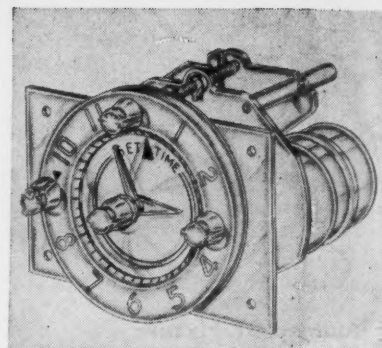
☐ **Hurry! Send data and price on new Windofans!**

Firm Name.....

Individual.....Title.....

Address.....Zone.....

City.....State.....



### Radio Clock Timer

The RC-3021 radio clock timer, is a combination of two independent timers operated by one motor. One timer is a manual "on", automatic "off" interval timer (slumber switch) to control an interval up to 60 minutes. The other is an automatic "on" timer to "catch" a program at any time within twelve hours. It is possible to go to bed with the radio playing for up to 60 minutes to lull the user to sleep and still have it turn on again automatically in the morning to waken the user. Unit is designed to be built into the radio cabinet as a part of the original equipment. International Register Co., 2614 W. Washington Blvd., Chicago 12, Ill.

### Baking Varnishes

Two new clear baking varnishes, Synthite BC-301 and BC-302 have been announced. BC-301 is composed of phenol formaldehyde resin and selected drying oils, and was formulated for applications where heat resistance and bonding is required. It is particularly recommended as a transformer and coil varnish and can be used on all types of coated magnet wire. It can be applied by atmospheric dip or vacuum impregnation. BC-302 is a blend of synthetic gums and drying oils and formulated to give a rapid cure. The cured film possesses dielectric properties plus a resistance to water, oil and chemicals. It is adaptable to such applications as armatures, both low and high speed, stators (fractional hp. and up), transformer coils, motor fields, fluorescent ballasts. Also for all types of coated magnet wire. John C. Dolph Company, 1060 Broad Street, Newark 2, N. J.

### Tester


The new portable electronic bar-to-bar tester is a testing device specially designed for indicating and locating shorts in armature windings. Its test unit contains a vacuum tube oscillator



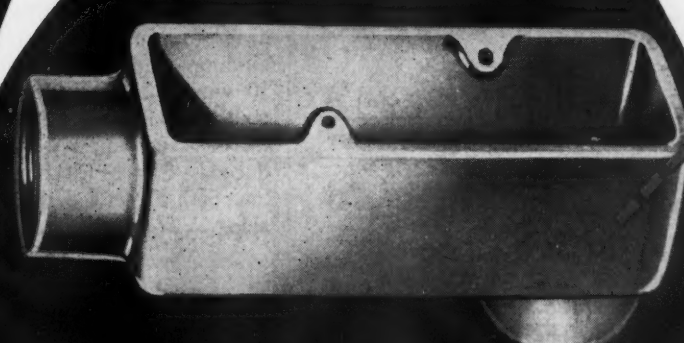
# 10 YEARS CONTINUOUS EXPOSURE

Time proves the lasting power of **KILLARK corrosion-proof Alomalloy fittings!**

Now it can be told — and shown . . . the amazing results of ten years constant exposure of Killark's Alomalloy Fittings and Fixtures! Rain, sleet, snow, acidic atmosphere and countless other corrosion factors have hammered unmercifully at Killark Alomalloy Fixtures and Fittings—*Without a Spec of Rust or Corrosion Resulting!* Convincing proof why you can be sure your installations will last longer — and give more dependable, trouble-free service — if they are protected by these outstanding Killark Alomalloy Fittings and Fixtures.

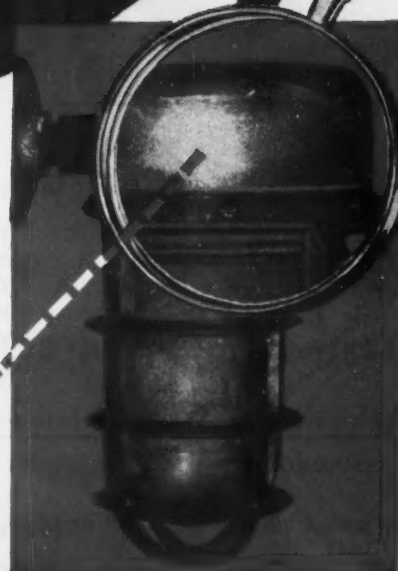


After ten years of weather torture, this iron fitting shows extreme corrosion — and the prospect of near-future installation trouble.



Made of the same Killark Alomalloy that gave perfect protection for ten years to the Killark Fixture shown at right, this smooth Killark Alomalloy Fitting clashes greatly with the corroded iron fitting shown above . . . mute evidence of decades of more dependable service.

## NOT A TRACE OF CORROSION!



The Light That Will Never Fail . . . because of corrosion or rust! In as good condition today, after 10 years of outside exposure, this Killark Alomalloy Fixture shows no sign of rust or corrosion — no sign of ever changing!

Killark Alomalloy Fittings and Fixtures are used in underground conduit, utility and chemical plant installations throughout the world. Their combination of high-strength, safety, smoothness and rigidity — *plus* corrosion-resistance pays big dividends — on every installation!



*Killark*

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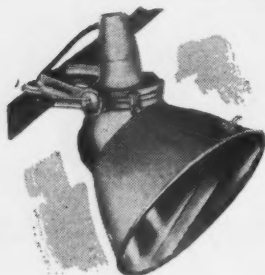
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SAINT LOUIS 13. MO.



GENERAL ELECTRIC

# Floodlights

*available from stock*



## For area and sports lighting

Type L-69—1000/1500 watts. The high-efficiency unit, suitable for large or small work, construction or playing areas. Tuflex door-glass spun-sealed to Alzak\*-processed aluminum reflector. Medium or wide beam. Also open types of either aluminum or porcelain enamel.



## General-purpose Floodlights

Types L-82 and L-83—500 and 1000 watts. Portable as well as standard base. Alzak\*-treated aluminum with hinged door. Narrow medium or wide beam. Also heavy-duty 200/250 watt cast-aluminum floodlight.



## Handy Low-cost Floodlights

Types L-65 and L-66—100 and 200/300 watts. Priced as low as \$3.95. Aluminum, with door glass included. Also new outdoor lamp holder with floodlight base for 150-watt Par 38 projector-spot or -flood lamps—only \$2.95 without lamp.

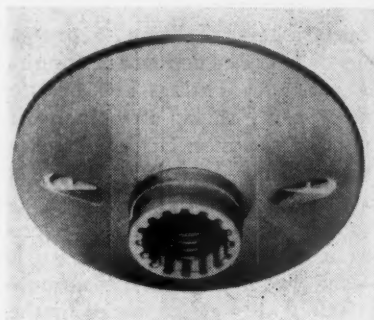
GENERAL ELECTRIC AGENTS STOCK THE COMPLETE LINE OF G-E FLOODLIGHTS

For more information, phone your nearest G-E agent or write Apparatus Department, General Electric Company, Schenectady 5, N. Y.

\*Manufactured under Aluminum Company of America patents.

GENERAL  ELECTRIC

section which generates 3,000 cycle a-c voltage of about 15 volts no load, and an electronic voltmeter section which has an output impedance of 500,000 ohms to the vacuum tube amplifier. It is equipped with a test prod unit which can be adjusted for various commutator diameters and bar spacings, and a cathode ray or magic eye indicator mounted on the test prod. Tester is mounted in a 13 in. by 8 in. by 8 in. black enamel metal case. It weighs 23 lbs. and operates on 110 volts, 60 cycle a-c. National Electric Coil Company, 794 Chambers Road, Columbus 16, Ohio.



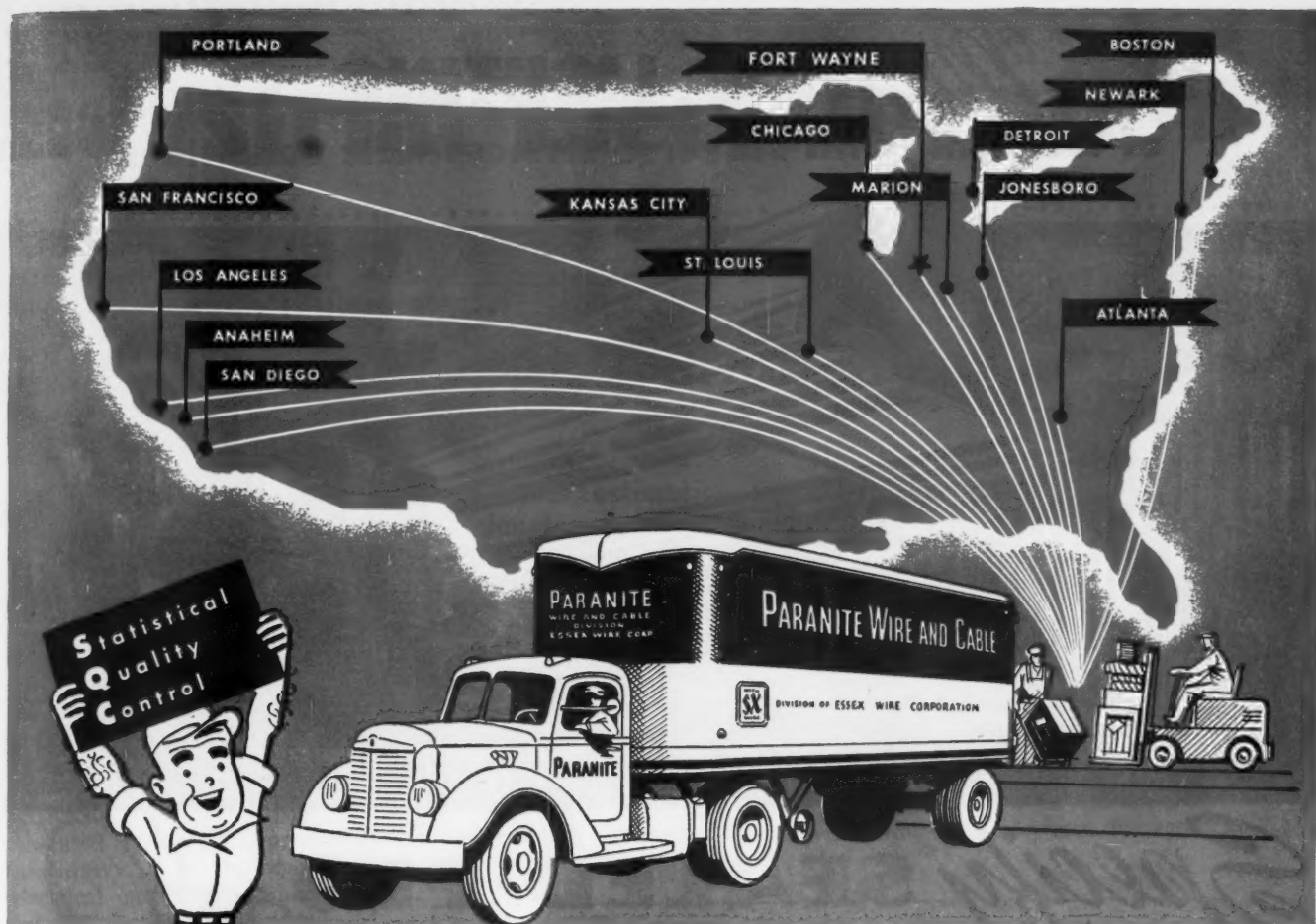
## Ceiling Receptacle

A new oversized combination 3 1/4 in. and 4 in. keyless ceiling receptacle has been announced. Known as No. 277, it measures 5 inches in diameter. It is made of white Urea or brown Bakelite. Some of its features are heavy terminals, solid rivets, and large binding head screws suitable for No. 10 wiring. A smaller ceiling receptacle for combination use on either 3 1/4 in. or 4 in. boxes is also being produced. Slater Electric & Mfg. Co., Inc., 56th Street & 37th Avenue, Woodside, N. Y.

## Hangers

Series No. 170 and No. 180 one-piece deep-canopy disconnecting and lowering lighting fixture hangers for outdoor applications are available. These hangers facilitate rapid cleaning, relamping and repairing of outdoor fixtures located in plant area, switch yards, parking zones, loading docks and shipping platforms. Assembly consists of two members, upper and lower. Fixed upper member contains pulley wheel for the operating chain or cable, guide tube for repositioning, and a pair of cup type contacts to which power feed lines are attached. Lower member supports light fixture and contains positioning stem, latching mechanisms and ball-

[Continued on page 179]



## EASY WAY TO GET *Quick* DELIVERY

OF YOUR ELECTRICAL WIRE AND CABLE NEEDS

Paranite wire or cable is made under the watchful eye of SQC—Statistical Quality Control! Nothing is left to chance. Scores of graphs, tests, measurements—figures and figures—by columns and rows of columns—are drilled and marshalled, compiled and analyzed with individual operations still in progress. With SQC on guard you can confidently recommend and use Paranite for lasting satisfaction.

Is prompt delivery of electrical wire and cable on your worry list? You can get fast service by calling on your Paranite wholesaler.

The Paranite Supply Line enables him to fill your order *when you want it*. What your wholesaler needs to supplement his own stock he can get with speed and dispatch from a completely stocked factory warehouse that's literally right in his own backyard. You get delivery of your electrical wire and cable without delay.

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**PARANITE WIRE AND CABLE**

Division of ESSEX WIRE CORPORATION

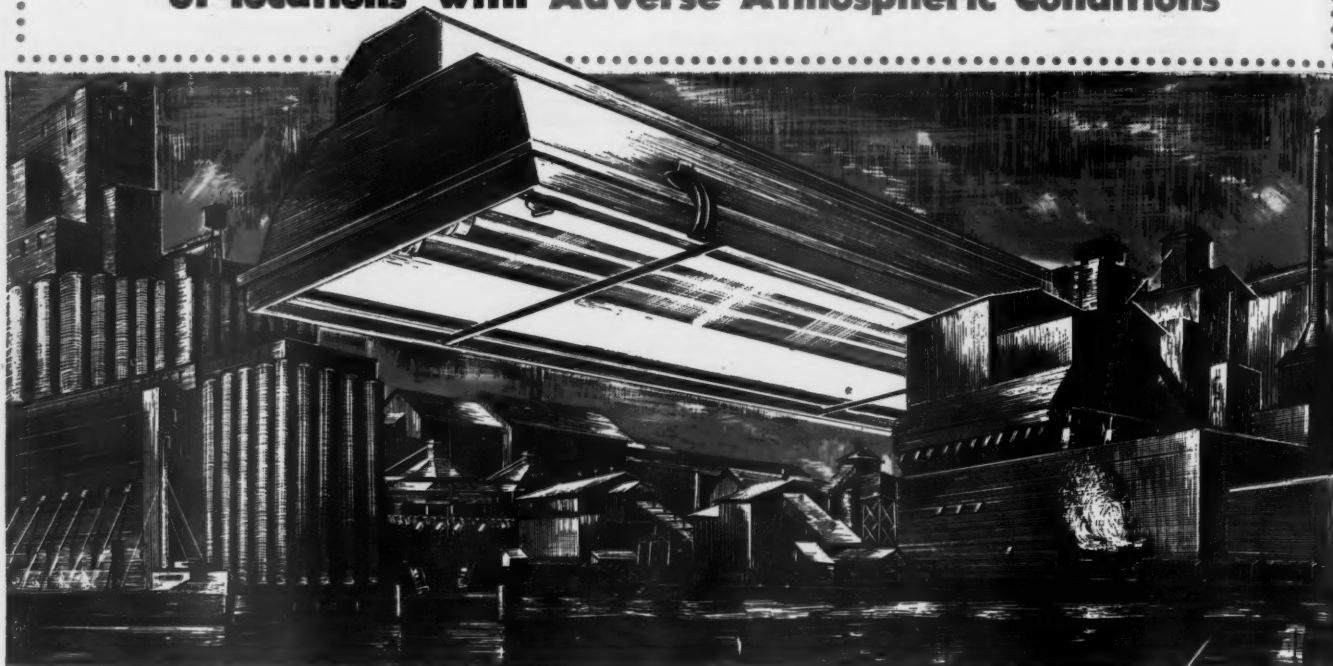
FORT WAYNE 6, INDIANA

WAREHOUSES\* AND SALES OFFICES: \*Atlanta, Ga.; Boston, Mass.; \*Chicago, Ill.; Cleveland, Ohio; Dallas, Texas; \*Detroit, Mich.; \*Kansas City, Mo.; Los Angeles, Calif.; \*Newark, N. J.; Philadelphia, Pa.; \*Portland, Oreg.; \*St. Louis, Mo.; \*San Diego, Calif.; \*San Francisco, Calif.

ELECTRICAL WIRES AND CABLES "BETTER THAN CODE REQUIRES"

# FOR *Modern* LIGHTING

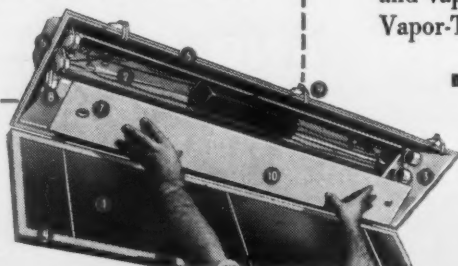
of locations with Adverse Atmospheric Conditions



## *Specify* "SEALED-FLO 40"

### THESE 10 BENJAMIN FEATURES ASSURE BETTER LIGHTING OF DUSTY OR MOIST LOCATIONS

- 1 **A Double-Strength Grade "A" Clear Glass Cover** also available with heat and impact-resisting glass.
- 2 **High Light Output**—Twin-Lamp Units have an efficiency of 67% or more of the output of the lamps; Triple-Lamp Units 61% or more.
- 3 **Porcelain Enamel** on all inner reflecting surfaces, combining a high reflection factor of 82% with a high diffusion factor.
- 4 **Dust-and-Vapor-Tight Seal** formed by wire reinforced woven asbestos gasket.
- 5 **"Sealed Bend" Construction**, which resists rust and corrosion.
- 6 **One-Piece Steel Construction**, completely covered with easy-to-clean **Porcelain Enamel**.
- 7 **Self-adjusting, hand-operated "Lok-Latch" Fasteners**, which permit easy removal of the reflector plate.
- 8 **Exclusive, unbreakable "Spring-Lex" Lamp-holders**, which facilitate relamping and lock lamps into position.
- 9 **Three Spring Tension Clamps**, which allow easy opening of the cover.
- 10 **Removable Reflector Plate**, which makes possible easy access to control equipment and wiring.



"Sealed-Flo 40" Fluorescent Lighting Units are designed to solve the problem of how to provide modern lighting in locations where conventional-type fluorescent units do not meet with Underwriters' Laboratories approval. To these many locations in industry where atmospheric conditions are adverse or hazardous, "Sealed-Flo 40" Twin-Lamp and Triple-Lamp Units bring the full benefits of modern fluorescent lighting.

Under such severe operating conditions "Sealed-Flo 40" Units function at peak efficiency and at minimum operating and maintenance cost. Important to such performance is the "One-Piece" construction with an over-all protective coating of durable, easily cleaned Benjamin "Life-Time" Porcelain Enamel.

"Sealed-Flo 40" Units satisfy all requirements of Underwriters' Laboratories for installation in Classes II, III, and IV hazardous locations. Such locations may be found in flour and feed mills, grain elevators, coal chutes, cotton gins, wood-working plants, warehouses storing baled waste, cocoa fibre, Spanish moss, etc., as well as all departments where combustible dusts may create fire or explosion hazards and where maintenance due to dirt and vapor is a problem. "Sealed-Flo 40" Units are also rated as Vapor-Tight by Underwriters' Laboratories.

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# Industrial Electrification

ENGINEERING • INSTALLATION • MAINTENANCE

## Bus Duct Distribution—Part I

Engineering data for bus duct layout, estimation, specification and installation are essential in selecting and planning an efficient industrial electrical distribution system.

By R. N. Blatchford  
Bulldog Electric Products Co.  
Detroit, Michigan

**E**NORMOUS amounts of power are essential for today's production machinery. Power, as represented in electrical current, must be transmitted from its source and distributed to "load" areas. Electrically fed machinery creates "load" areas and demands electrical distribution systems that perform with highest efficiency.

American industry skyrocketed to its present performance peak in the prepared path of electrical development. For without the perfection of electrical methods, industrial growth would have been stunted in its infancy. Today, industrial plants are not only provided with the most modern electrically-driven machines, but they are also offered the most modern method of distributing their electricity—bus duct.

But, let us briefly review the development and background of bus duct, today's most efficient distribution system. We find that electrical energy has not always been the omnipresent servant of production. Only a few years ago electrical power, not the production picture, dictated the pattern for plant layouts. Equipment had to be installed where it could best be harnessed to long overhead drive shafts turned by single large motors (an inheritance from steam power era). Material flow and production sequence were of necessity subordinate to consideration of available space near the source of power. Each addition to original machines had to be located to conform to the power layout, not where it would best fit production requirements. With plant expansion, the production floor became a maze of un-

coordinated machine operations. Because with drive shaft power systems any revision in production machinery layout was almost beyond consideration. For, the labor involved to dismantle, revamp and re-install original power system was prohibitive.

As the design of electrical and ma-

chine equipment was improved, a better idea for distribution of electrical power evolved. Machines were run by individual motors fed through cable from centrally located panelboards. This was a vast improvement over the old "shaft-and-belt" method but still left much to be desired. Aside from the masses of

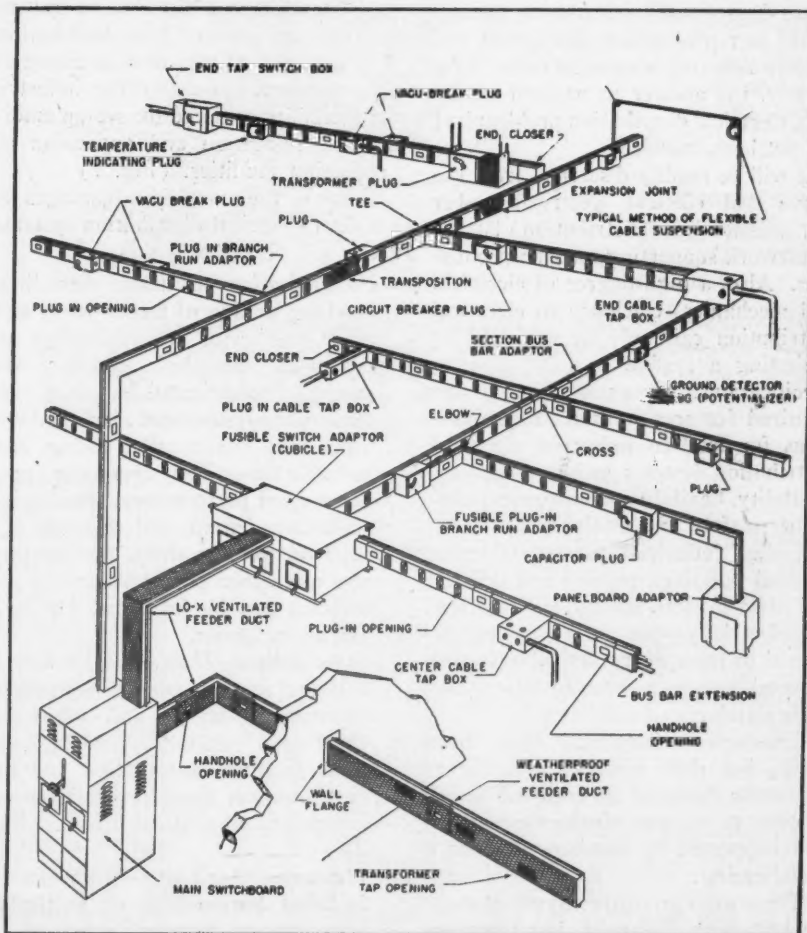
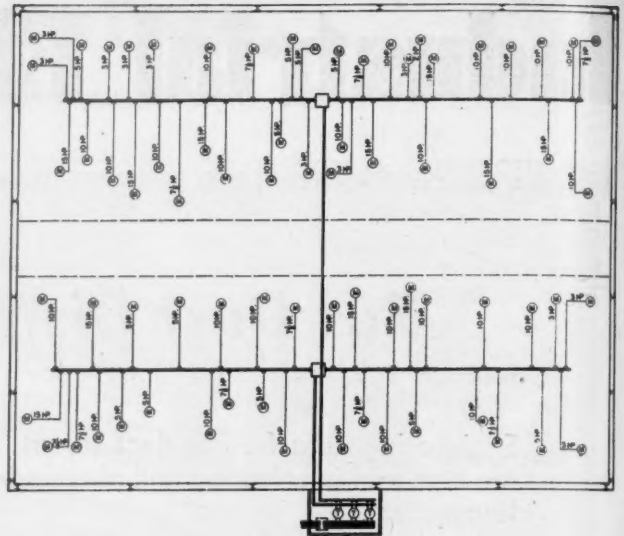
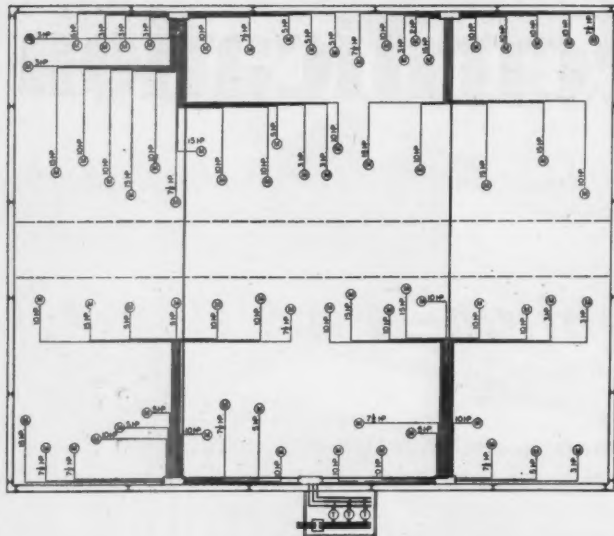


FIG. 1—Feeder duct and plug-in bus duct sections are used in combinations with a wide variety of accessory fittings to form a complete electrical distribution system for light and power.



**FIG. 2—**Selection of an electrical distribution system should provide for possible changes in production requirements. Relocation of equipment is often expensive or difficult with "fixed outlet" wiring (left) but, by distributing power through the heart of the load areas with convenient tap-off points (right), the distribution system becomes flexible, convenient and salvable.

cable required and such factors as excessive voltage drop, the "fixed outlet" nature of the system made it inflexible. As the possibilities of mass production were developed, it was frequently necessary to move machinery and even entire departments. Almost any change meant lost production time while expensive rewiring was undertaken. Obviously, the answer to modern industry's electrical distribution problem had not yet been found.

It will be readily discerned from the above that efficient electrical power transmission or distribution is the framework supporting modern production. Also, a high degree of electrical and mechanical efficiency in electrical distribution can only be achieved by designing a system to fulfill definite specifications. Generally desired and required features written in specifications for modern industrial electrical distribution systems include adequacy, reliability, flexibility, convenience, salvability, safety and efficiency.

Today, industrial plants and commercial buildings require and demand the most modern method of distributing electricity—bus duct, a system designed to meet every desirable feature of specifications written to incorporate high standards of efficiency.

Although refinements have been made, bus duct remains basically as originally designed, an enclosed busbar system of copper conductors spaced and supported by insulators within a metal casing.

There are two distinct types of duct: feeder, with balanced low-reactance phasing; and plug-in, for convenient power tap-off. Both types are produced in a wide range of ratings for 600 volts

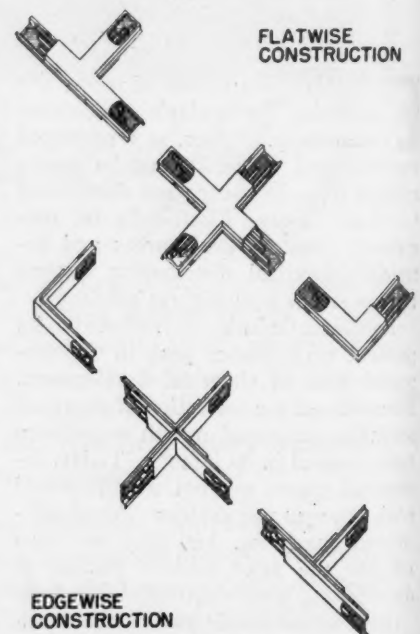
or less and in 2, 3 and 4 pole construction. Each type has distinctive features and may be used separate from the other. However, they are also designed to supplement each other and are frequently used in combination to form a complete electrical distribution system for light and power. This distribution system furnished an added incentive to mass production by allowing industry the flexibility required for set-up/modification, relocation and expansion of production facilities. (Fig. 1)

Some of the manifold advantages of bus duct electrical distribution systems are:

**Prefabrication**—Cutting, threading, bending, pulling of feeder wires and other on-the-job manufacturing of outmoded electrical systems are costly. Prefabricated bus duct systems in ready-to-install, factory-built units save the installer money and valuable time. They also assure predetermined performance. Before installation, definite and accurate figures on voltage drop, temperature rise and other performance characteristics can be furnished for each and every layout.

**Standardized Unit Construction**—Bus duct sections and fittings simplify estimates, layouts and orders for electrical systems. Standardized units facilitate installation and assure less lost time for additions or alterations to original layout. (Fig. 2).

**Maximum flexibility**—Duct can be installed horizontally or vertically, edgewise or flatwise, mounted on wall or ceiling, suspended from structural steel or messenger cable. Fittings such as elbows, tees and



**FIG. 3—**Elbows, crosses and tees for plug-in and feeder duct are designed for either edgewise or flatwise mounting, making it possible for runs to follow any layout or building contour.

crosses adapt bus duct runs to any layout or building contour. (Fig. 3). Bus duct is also readily taken down and re-installed in new locations to meet major revisions in plant layout. Additional system flexibility is provided, through tap-off facilities, when moving individual machines for better production sequence. In these instances bus duct branch circuit tap-off devices furnishing power are removed from duct run, moved with machines to new locations and inserted at most convenient plug-in opening to once again furnish power



required. Bus duct systems provide power for individual loads as quickly and easily as you tap an outlet in your home.

**Convenient Plug-in Openings**—Wherever production necessitates concentration of machinery, a load area is created for the electrical system. Machinery and electrical equipment within load areas are frequently shifted, added to or relocated for better and faster production. Thus, load areas require electrical distribution systems having numerous, convenient, accessible and flexible outlets. Regularly spaced openings (5 on each side of every 10 ft. section) permit plugging-in of branch circuit protective devices called plugs. Plugs may be mounted on either or both sides of duct for convenience, uniform current density distribution, better heat dissipation, greater flexibility, even weight distribution and increased efficiency of bus systems.

**Localized Control**—Changing designs, new production programs or expansion of facilities require frequent and fast shifting of machines from one location to another. As electrical systems are closely allied with machine tool set-up, it is imperative that electrical systems be designed for quick change-over. This can be done through properly designed, localized control permitting individual machines to be switched off and on, removed or added to line, or relocated in another area without disturbing or disrupting production of other equipment connected to the electrical system. Plug-in bus duct offers the maximum in efficient, localized control by providing convenient tap-off outlets at each motor location. BUStribution plugs can be moved with machines and plugged in at new locations with minimum loss.

**Safety**—Bus duct not only permits quick and easy tap-offs, but provides safety factors never before known when connecting machinery to the electrical system. For all current carrying parts of entire bus duct system are steel enclosed to provide dead front exterior surfaces. Also, the electrical connections for tapping off power require no splicing, taping or other on-the-job fabrication—simply raise plug-in tap-off device, wired to machine, to most convenient opening and plug it in. No need with this electrical system to shut down your power or interrupt production of machines not being moved. It's safe to plug-in or remove tap-off devices "hot" with steel enclosed bus duct.

**Salvageable**—Labor expended installing an electrical system cannot be reclaimed. But material if properly

selected for long life and used in designs featuring relocation adaptability and complete salvability represents a tangible investment. Many systems require a major expenditure in labor, and materials used in original installation cannot be relocated or salvaged economically. They therefore become a constant and continuing expenditure for every

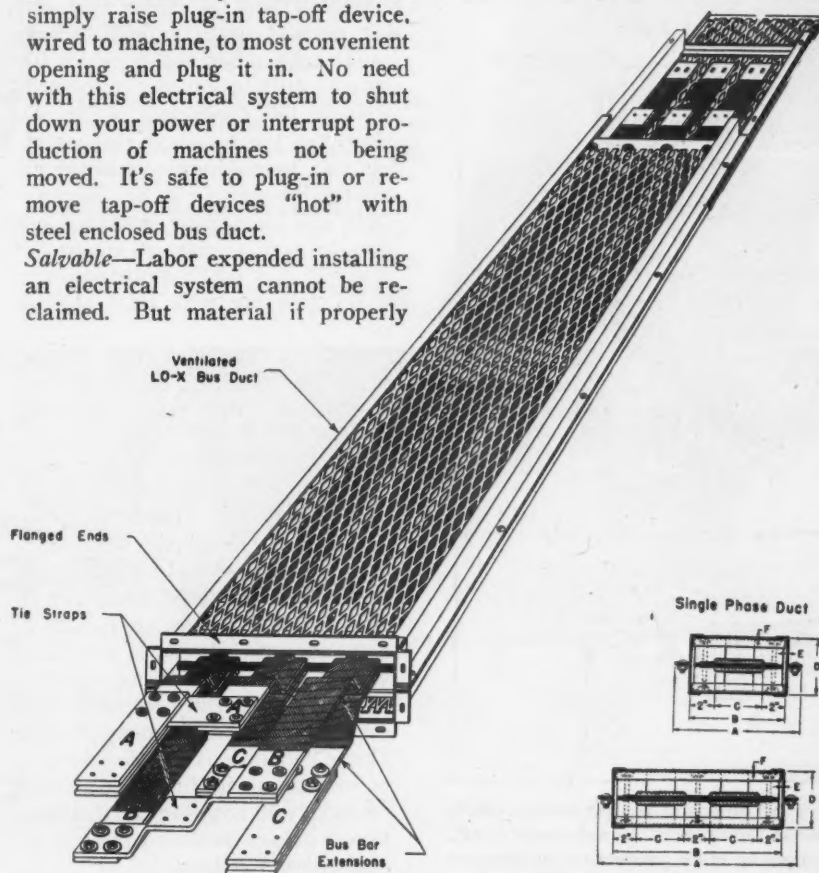


FIG. 4—Paired-phase arrangement of bus bars in Lo-X (low reactance) feeder duct reduces reactance and provides high efficiency transmission between transformers, main protective equipment and plug-in duct runs. Ventilated casing permits visual inspection of bars, reduces temperature rise, and increases current-carrying capacity of conductors.

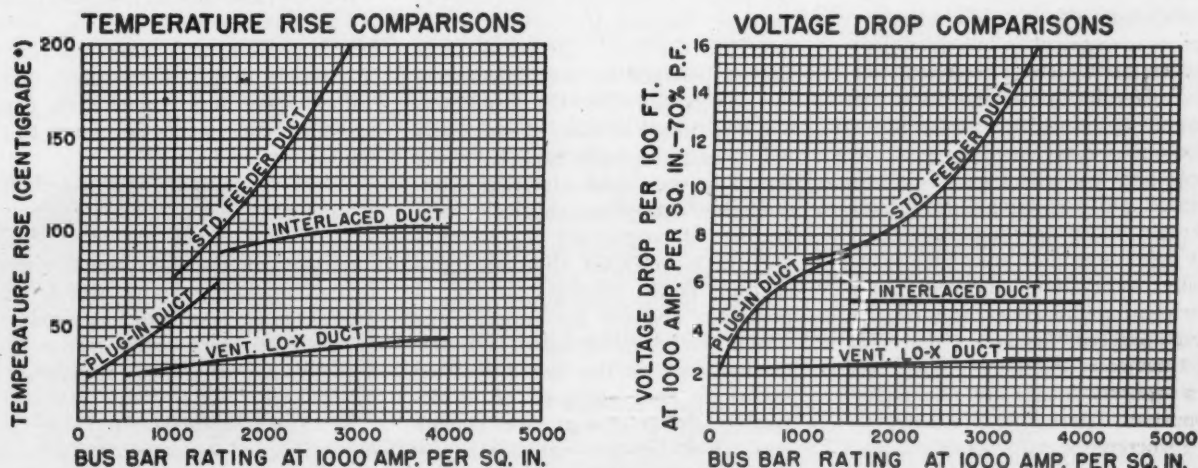
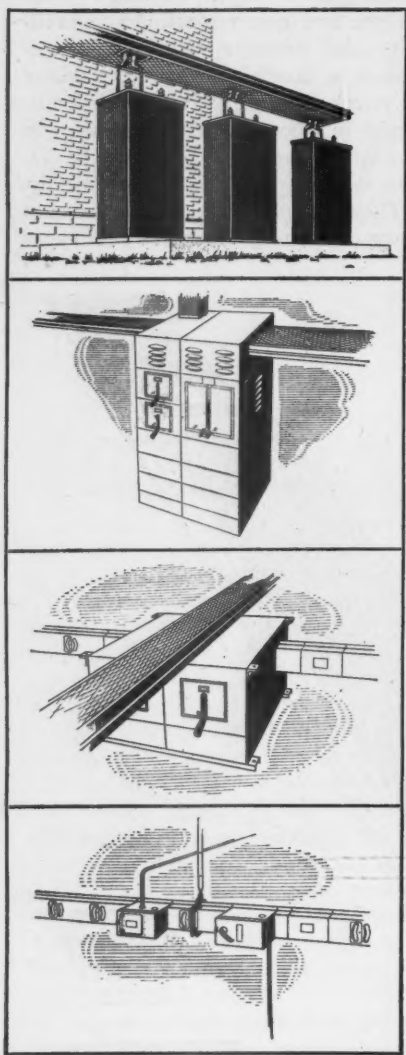


FIG. 5—These temperature-rise and voltage-drop comparisons illustrate the effects of duct design on performance characteristics. These relative values should be considered at the time bus duct is selected.





**Typical enclosed busbar system starts at secondary side of transformer bank, proceeds to main protective equipment and individual load centers. Feeder bus then gives way to plug-in duct and carries current throughout areas requiring flexible distribution of power.**

change required by production. It is reasonable then for installers to consider an investment in bus duct electrical system which can be used over and over again in different locations without material loss and with a minimum of labor.

**Mechanical and Electrical Strength**—closely allied to salvability, design and the use of proper materials. Bus duct systems employ steel enclosures painted to exclude rust and other deteriorating influences, rugged vitrified porcelain insulators that will not carbonize and pure copper bus bars properly spaced and adequately supported. These long-life materials are incorporated in designs utilizing their inherent properties to provide a system that is electrically efficient, mechanically strong and damage resistant.

**Low Voltage Drop**—All electrical systems have some voltage losses and these losses are more pronounced in large a-c circuits than in d-c or small a-c circuits. In a-c circuits, the magnetic field surrounding each conductor results in reactance, which, added to conductor resistance, makes the total voltage drop greater. Close spacing of paired phase bus bars in feeder type bus duct permits magnetic fields to neutralize each other and provides for uniform distribution of current densities in the conductors. (Fig. 4). Thus, reactance voltage drop is effectively reduced and conductor resistance lowered. (Fig. 5). Mechanically and electrically perfected bus systems permit greatest amount of power to flow continuously to places of ultimate use with least possible loss.

**Visibility**—Facilities for maintenance men to check conductor connections whenever desired and supporting insulators (of a material that will not deteriorate with age) are two of this system's most desirable features. Handhole covers may be easily removed for inspection of bus bar joints and bolted bus bar connections tightened whenever required. These covers are located on both sides at each end of every duct section. Thus, uncertainty regarding two items frequently responsible for electrical failure in many systems (loose connections and deterioration of insulation) is eliminated through visibility and accessibility, and selection of proper insulating material for supporting bus bars.

**Unique Insulating Properties** of bus duct systems, which employ porcelain insulators to support bus bars and air as the main dielectric, have proven that electrical systems would last longer if physical insulation did not fail. Section 10, Chapter 10 of the 1948 National Electrical Code says, "It should be noted that even the best grades of rubber insulations will deteriorate in time, so eventually will need to be replaced." Knowing the deficiencies of electrical conductors employing physical insulators that deteriorate or carbonize and track, bus duct eliminated this limiting factor through the use of porcelain and air for support and insulation. Air, the main dielectric of bus duct, is the best insulation known to man when all of its desirable characteristics are considered. For, air does not deteriorate, it is plentiful and it doesn't cost anything. It is the only insulation which has the faculty of instantaneously replenishing itself. As the air

circulates in the factory, it changes in the bus duct run, so how can it ever age or deteriorate?

Another outstanding plug-in bus duct feature is its ability to contend with surge currents, short circuits and grounds. A bus duct system, adequately protected, can be returned to service immediately after power failures by merely removing the cause of the failure, replacing the fuses or resetting the circuit breaker. Air again makes this possible because it automatically and instantaneously reinsulates the duct system as soon as the fault is cleared by the operation of the fuses or breaker. You can't do that with conductors employing a physical insulation, because the insulation would be damaged and new conductors would have to be substituted for the damaged conductors before the circuit could be placed back in service.

We've seen that air constantly and automatically replenishes itself to provide an ever new insulation between conductors. In addition, porcelain and copper do not deteriorate, and steel, when properly maintained, will last indefinitely. Also, with bus duct there are no moving parts—hence nothing to wear out.

Just think! *Nothing to wear out!* Couple that with the salvability story! Before, it was common practice for industry to abandon unsalvageable electrical distribution systems even though they represented very substantial investments.

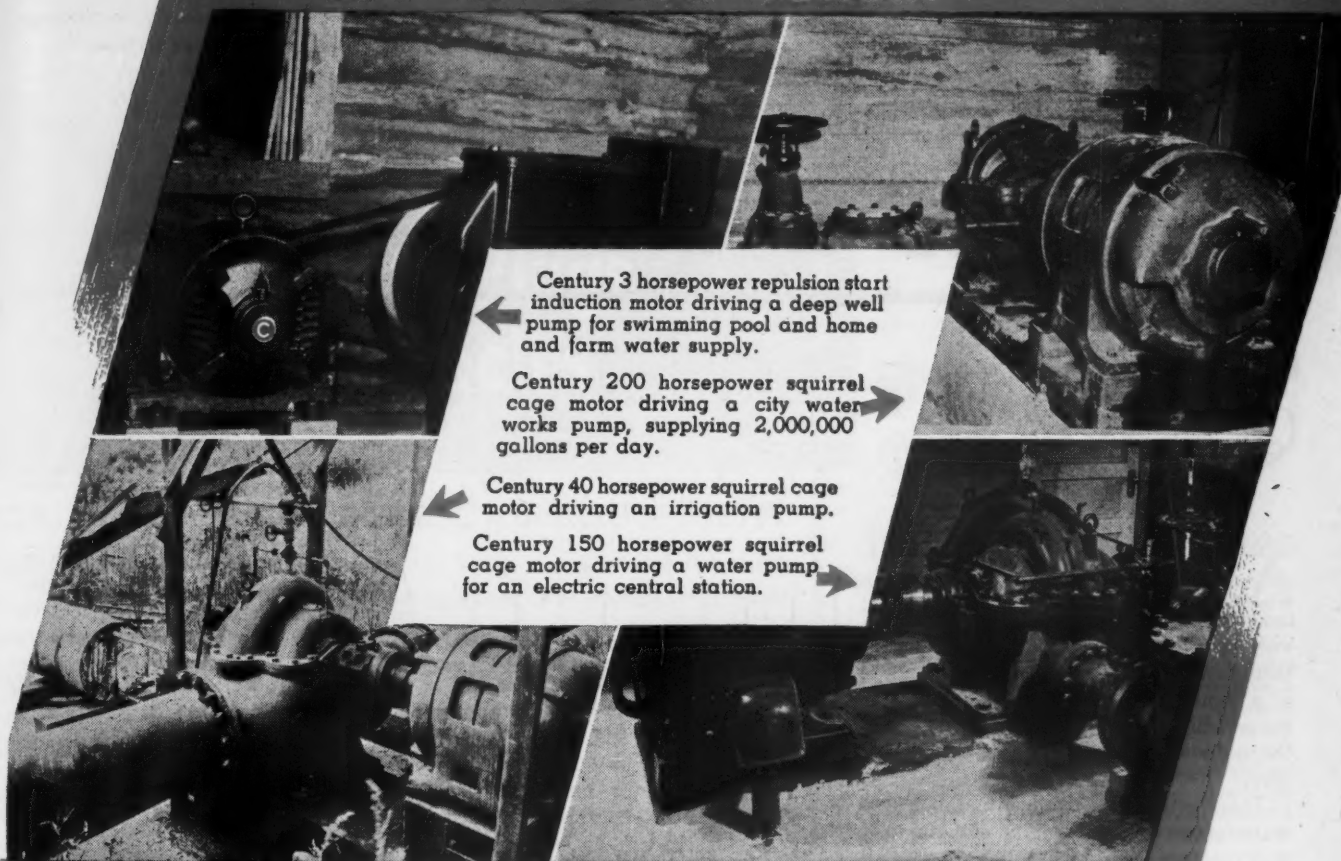
The salvage value of such systems was eliminated by the prohibitive cost in time and labor required to dismantle and reinstall them. Add to this the large percentage of scrap due to time worn cable insulation and other materials that invariably occurred during salvage operations and it can be seen why those systems were abandoned.

But the same industry wouldn't think of abandoning drill presses, lathes, punch presses, and other machinery. Nor would they abandon office equipment—typewriters, calculators, desks, files and other pieces necessary to the conduct of business.

Why? Because machinery and office equipment are readily salvable and long lasting. Now we have similar conditions in the distribution picture. Being standardized and prefabricated it is also readily salvable at a low cost in time and energy and since nothing need be thrown away, the savings of investment is 100 percent.

With materials selected for their durability and incorporated into a design that utilizes their inherent stamina, bus duct is a product that will provide many, many years of trouble-free service.

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← Century 40 horsepower squirrel cage motor driving an irrigation pump.

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Century pump motors are particularly adapted to the requirements of pumping service. They start and run smoothly and quietly—and with a minimum of vibration Century's triple insulation effectively resists humidity and dampness.

To meet the requirements of any surrounding atmosphere, Century motors are supplied with drip proof, splash proof, totally enclosed fan cooled or explosion proof frames.

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# Reader's Quiz

## Motor Protection

**Q** **UESTION 310**—How can a 4 circuit motor winding be protected against burnout? Should one or more circuits open up?—H. S.

**A.** TO QUESTION 310—Standard starters will not protect motors against open circuit burnouts.

A temperature sensitive set of contacts mounted directly on the windings of a motor, or as close as possible to the winding, will open the starter when the motor reaches a predetermined heat level.

This device is available as a standard manufactured item, and is similar to that incorporated into fractional horsepower motors by a number of motor builders.

As many of these units as necessary are placed in series with the holding coil of the contactor, depending on the size of the motor and the degree of protection desired.—A.J.L.

**A.** TO QUESTION 310—The question is that of how many relays should be used and how they should be connected in the motor circuit. The connections of overload relay coils in the most commonly used a-c motor circuits to protect the motors against overloads are shown in the following diagrams.

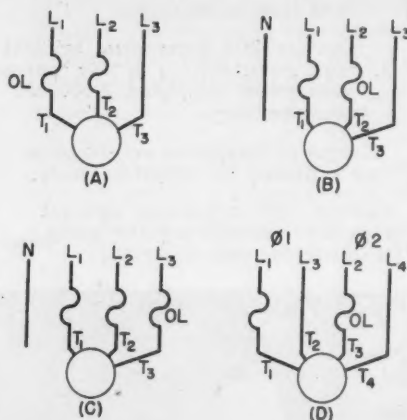
Three phase induction motors are protected by overload relays in two phases as shown in sketch A both against short circuit and overloads.

If the motor is connected to a 4 wire network system, overload protection in two phases is sufficient, as the neutral wire has no effect on the balanced load current of the motor. See Sketch B.

However, if the overload relays are to protect against winding faults or short circuits, any one of the three phases may short circuit to ground, and three relays, one in each phase are required. See sketch C.

Two phase motors are protected against overload and short circuit by two overload relays, one in each phase. See sketch D.

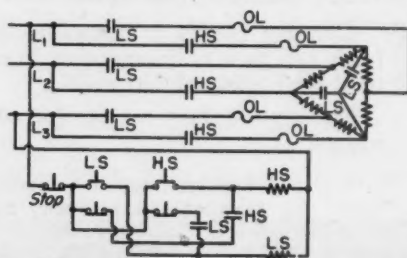
When selecting the proper size of overload relay to protect a given mo-



tor, its service factor must be considered. Standard continuous rated motors for 40 C rise have a service factor of 15%, which means that the motor can deliver 15% more power than its nameplate rating indicates without undue heating, and overload relays should be selected for a current of 115% full load motor current.—R.W.M.

**A.** TO QUESTION 310—Your question of a 4 or 2 circuit motor being protected against burnout evidently refers to a multispeed motor. Yes, a set of overload relays for each speed must be provided, even for constant horsepower motors, since the full load currents for the different speeds vary.

I am illustrating by diagram of a 3 phase consequent pole motor (a single winding connected up through starter switch in 2 ways for 2 speeds, one speed twice the other.) The circuit connections are changed by the multi-speed starter. Such a starter is constructed differently for multi-winding



OL—Overloads relays  
(2 for each speed)  
LS—Low speed  
HS—High speed

and consequent pole windings but in each case overload protection is provided for each and every speed.

This diagram is connected Parallel "Y" for low speed and series "delta" for high speed—hp. remaining same for each speed.—E.A.M.

**A.** TO QUESTION 310—An induction or synchronous motor may be protected against excessive damage caused by internal faults by the use of differential relays. As the name implies, any variation in current drawn by one or more legs of a polyphase motor actuates the relay, which in turn opens the circuit breaker; this is accomplished by having the current of each leg of the motor pass through the relay.

Differential relays are not commonly used on motors which can be readily replaced by a standard motor as the cost of applying and maintaining the protective system must be balanced against the probability of failure and cost of motor repair. Ordinarily a circuit will not open unless the motor is either being abused or was improperly manufactured and in the event of such a failure the motor should be thoroughly inspected and in motors of standard frames should be totally rewound. Motors in the larger sizes which are wound with heavy strap copper may be repaired by replacing the defective coil or coils.

Ordinary thermal or magnetic overload relays will act to trip out a motor too late to prevent damaging adjacent coils.—T.J.H.

## Servicing a Mine Hoist Motor

**Q** **UESTION 311**—I was recently called to service a 500 hp. mine hoist motor. The pedestal bearing surface was found to be pitted due to a current flowing from the motor shaft to the bearing. This is a 220 volt wound rotor motor, 60 cycle, with the start point of the rotor winding grounded to the shaft. Is it pos-



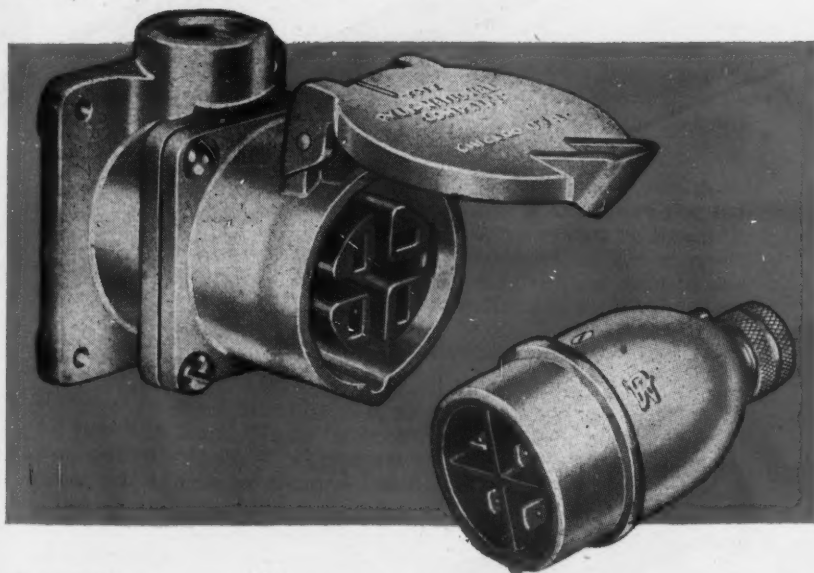
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**QuelArc • Circuit Breaking Series** Unique partitioned insulation provides long insulated paths through air and across surfaces for exceptional protection in these current rupturing devices. Galvanized cast metal housings, bakelite insulation and individually renewable contacts insure long service life. Ratings 20, 30, 60, 100 and 200 amperes, 250 volts DC, 600 volts AC—2, 3, and 4 pole—grounded through shell or extra pole. Threaded cap, plain and hinged spring door housing styles are available.



1, 2, 3, 4, 6, 8 pole interchangeable contact units



### Triploc and Multiple-Circuit Series

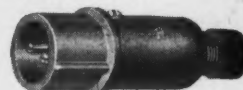
A line of exceptional versatility, unequalled in the heavy duty field, with a virtually unlimited number of assembly combinations for varied applications. Offers a selection of 1, 2, 3, 4, 6 and 8 pole contact units which are interchangeable and reversible in any single set of housings. Many types of single housings available of pressed steel with automatic lock and of cast metal threaded for watertight gasket seal. Multi-Circuit housings—2, 3 and 4 gang—available for combinations up to 32 poles. Ratings 15 and 20 amperes, 250 volts DC, 460 volts AC—circuit breaking. Pressed steel fusible and fuseless plugs measure 1 1/4" outside diameter.

### Midget Triploc Series

Same construction features as Triploc except for much smaller outside diameter of plug shell—only 1 1/4". Interchangeable and reversible contact units—2, 3 and 4 pole—are of the flat blade type. Rated 10 amperes, 250 volts; 15 amperes, 125 volts.



2-Gang Receptacle



Fusible Plug



Fuseless Plug

### General Purpose Series

Available with cast metal housings in many types for circuit breaking and disconnect service. 30 amperes, 125 volts DC, 250 volt AC—1, 2, 3, 4, 5 and 6 pole. 60 amperes, 250 and 600 volts—3, 4 and 5 pole. 100 ampere, 250 and 600 volts—2, 3 and 4 pole. Also many special types, fusible and fuseless, for varied applications.

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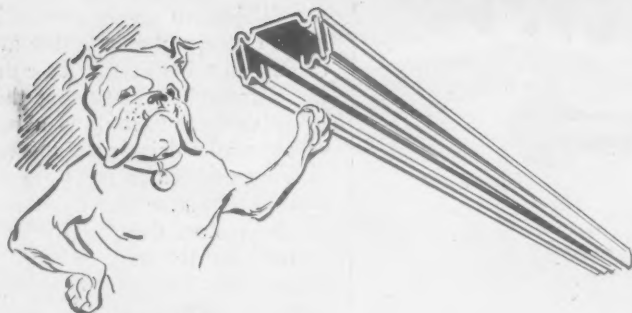
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Slotted **Bulldog** Universal Trol-E-Duct both supports and supplies current to these banks of fluorescent lighting fixtures. **Bulldog** manufactures Vacu-Break Safety Switches • SafeToFuse Panelboards • Superba and Rocker Type Panelboards • Switchboards • Circuit Master Breakers • "Lo-X" Feeder BUStrIBUTION Duct • "Plug-In" BUStrIBUTION Duct • Universal Trol-E-Duct for flexible lighting • Industrial Trol-E-Duct for portable tools, cranes, hoists.



# with a slot



**T**IRED of rewiring the whole plant every time you have to move or add lighting fixtures?

Let the current-carrying slot in Bulldog Universal Trol-E-Duct spot your lighting fixtures where and when you want them.

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Bulldog Universal Trol-E-Duct gives you truly *flexible* lighting. Trol-E-Duct's continuous slot makes it possible for you to add, remove or change lighting fixtures at will . . . without rewiring.

Twist-out plugs or trolleys tap current from any point along the continuous slotted opening which runs the full length of the Trol-E-Duct. These devices can be instantly attached or removed without disconnecting the current. Twist-out plugs can be snapped on or off the duct at any point; trolleys roll along duct to furnish mobile outlets.

## Entirely salvable

Prefabricated and standardized Universal Trol-E-Duct is comprised of durable steel sheathing enclosing solid copper bus bars. Made in lengths from one to ten feet, it readily supports weight of lighting fixtures and small tools. It can be dismantled and reinstalled at any time, without scrapping a single part. Existing systems can be easily expanded by adding standard sections and fittings. Capacity: 50 Amps., 250 Volts, Single Phase.

Call in a nearby Bulldog Field Engineer for more information on this modern, efficient lighting system. He will be glad to show you a typical installation in your own neighborhood. Or, write for descriptive bulletin from Bulldog direct.

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# BULLDOG



HEADQUARTERS FOR ELECTRICAL DISTRIBUTION



Inserting a twist-out plug in Universal Trol-E-Duct is easy! Simply insert plug contacts in slot of duct and give plug a quarter turn to lock firmly in place.

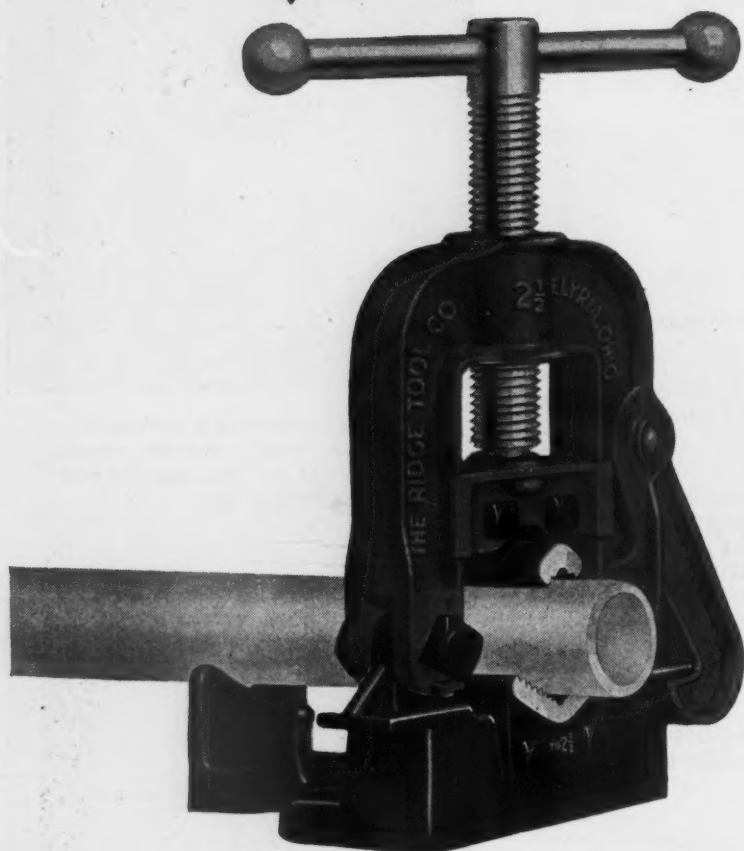


For a movable power source, use a trolley outlet, easily inserted at a Trolley Entrance Coupling. Metal wheels roll smoothly astride duct slot. Contacts are in constant touch with bus bars as trolley moves.



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sible for this current to be induced into the shaft from the stator or is it caused by a leak to ground somewhere in the rotor resistance circuit?—J.H.S.

**A.** TO QUESTION 311—One very possible cause of the pitted bearings in the case of J.H.S. is a grounded secondary circuit. This ground could be in the brush holders, the wiring to grids controlling the speed of the motor or in the grids and drum controller itself. In either case the current flow, assuming the pulley or drive of the motor is a belt drive or a metallic drive of high resistance, is from the center tap ground of the rotor through the bearings to the frame of the motor, then to the accidental ground on the grid side of the slip rings. This condition is also found in large single phase motors where there is a ground on the wound rotor of a motor having a grounded brush shifting device. It should be a fairly simple matter to lift the brushes and with an ohmmeter disconnect and test the several circuits until the ground may be located and corrected.—J.E.C.

**A.** TO QUESTION 311—The current causing the pitting of the bearing surface could be set up by electrolytic action between the motor shaft and the bearing metal. This could possibly be detected with a low reading d-c voltmeter.

If electrolysis is present, this could be overcome by shorting out the local circuit with a flexible shunt, connecting one end to the bearing housing and the other end to the motor shaft by means of a brush type contact.

The pitting might not be caused by stray currents. It could be the result of a purely chemical action. There might be gases present in the surrounding air, which combining with the bearing oil produce the injurious effect.—H.D.S.

**A.** TO QUESTION 311—It is apparent there is an insulation breakdown somewhere in the secondary circuit which allows the rotor induced current to flow between the grounded point of the star and the breakdown. The shaft being one side of the circuit and the remaining part of the rotor winding the other side of the circuit. Any current induced in the shaft alone could only be in the form of eddy currents and shouldn't cause pitting. The amount of pitting, or if fuse blows, could determine whether breakdown is in early stages of rotor-resistance or after full short-circuit of rotor. The latter would show it in the rotor winding.—J.V.H.

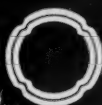
**A.** TO QUESTION 311—There are two possibilities which could be the cause of the pitted bearing

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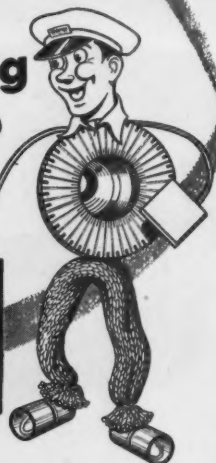
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surfaces found by J. H. S. The first is actual leakage due to broken down insulation in the rotor circuit which he, in effect, suggests himself. This is a very doubtful possibility and one which can be readily determined by an insulation test. The other is a static discharge situation whereby fairly high voltages are built up in the rotating member. Since the shaft is insulated from the pedestal bearing by a thin film of oil, the static voltage will build up until it is high enough to puncture the oil film. The electrical discharge will pit the bearing surface. After each such static discharge the oil film will seal itself and the process will then be repeated. It seems to me that we had a similar situation on a large rotary converter many years ago. I believe we corrected the trouble by grounding the rotor shaft to the pedestal by means of a spring brush connection.—W.B.M.

**A.** TO QUESTION 311—Irregularities in the magnetic circuit cause a small amount of flux to link the shaft, and so generate an e.m.f. between the shaft ends. This causes a current to flow from shaft to bearing, which causes pitting, unless one bearing is insulated. On end-shield-bearing machines, and on any machine with uninsulated bearings, this current should be measured by connecting a high-reading a-c ammeter to two low-resistance leads, one of which is held in rubbing contact with each end of the shaft. No current should flow when the other lead is transferred to the frame of the machine, and the presence of such current is a defect which should be corrected. The machine should be rewound or even redesigned.—H.T.F.

**A.** TO QUESTION 311—The question set by your correspondent JHS, strikes a familiar note here in view of a rather similar phenomenon which is still baffling us at this plant; and while I can bear your correspondent out in his assumption that a current can be induced in a shaft of a motor which would be of sufficient magnitude to cause pitting of bearings, I am not in a position to confirm the reason or cure.

Our problem arose in connection with one of a pair of 25 kva. induction frequency changers used for the conversion of 550 volt 25 cycle a-c supply to 110/220 volt 60 cycle for a four wire fluorescent lighting system. The set in question is an orthodox one consisting of an enclosed type 20 hp. motor running at 1430 rpm. pic-a-bac mounted on a slip ring converter which it drives by means of short vee belts. The system has a grounded neutral and the motor is not externally excited. This set and its sister had been in service for some considerable time,



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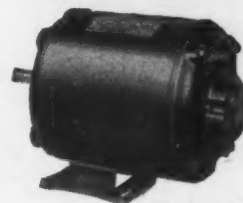
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taking turns in feeding the lighting system, when the number two set suddenly developed a howl which indicated bearing trouble. Upon examination it was found that the grease had disintegrated and had the appearance of melted butter, with an apparent deterioration in viscosity. The unit was stripped down and new bearings fitted to the offending alternator (the drive motor was in good condition). After no more than two weeks' semi-continuous running conditions this machine again produced the same symptoms and this time we called in motor experts, bearing experts, grease experts and the National Physical Laboratories. We could find no malalignment of equipment and vibration wave forms taken on an oscilloscope proved normal. The grease experts opined that the breaking down of the grease was due to the presence of water but could not agree among themselves that this was the primary cause; rather it appeared to be a secondary effect due to heat conditions within the bearing. The actual motor temperature proved to be normal and the load and non-load conditions metered satisfactorily. It was interesting to note that there was no suggestion of any trouble from the supply end of the system and even after the bearings had become pitted to a dangerous degree, there was no evidence of any electrical fault reflected in the fluorescent system being supplied.

The whole case was shot wide open when the laboratory report came back from the bearing people who definitely asserted that the microfilm pictures they had taken of the broken bearings was definitely indicative of an electrolytic condition. They went so far as to say that an induced voltage of the order of .5 of a volt and a current value of the order of milliamperes would be satisfactory to produce just such a condition as existed here. Tests with the oscilloscope failed to locate either the current or voltage wave form across the shaft but nobody could either agree or deny that one existed.

This time we decided to make up a collector shoe to run in the puller slot on the shaft end and this we connected to an independent ground. New bearings were fitted and an entirely new and recommended grease inserted. The system was started up again and the usual checks made and conditions found to be satisfactory. Three weeks later the same trouble arose again, and this time we obtained a considerable spark from our collector shoe under load conditions only. The sister machine continues to run satisfactorily but No. 2 unit is down again for the last time since we feel that it is throwing good money after bad to spend any more time in trying to cure our trouble.



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# Silicone News



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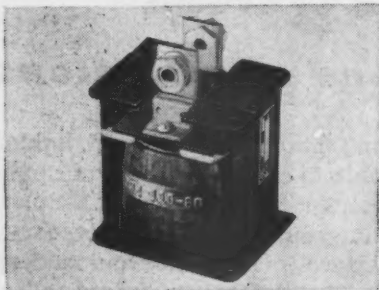


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Silicone insulated "Hi-Power" small space solenoids operate continuously in either 25 cycle 110 to 220 volt or 60 cycle 110 to 550 volt service.

Use of heat-stable Silicone Insulation has enabled engineers at B/W Controller Corporation of Birmingham, Michigan, to give you almost twice as much power without increasing the size or weight of their small space solenoids. For example, the new B/W "Hi-Power" solenoid has a push or pull of 32 pounds at 100% voltage compared with 17-18 pounds for a comparable Class "A" solenoid.

This increase in power per unit size is made possible by the exceptional heat stability of Dow Corning Silicone Insulation. This new class of electrical insulation gives long and continuous service at temperatures in the range of 200-260° C. "Hi-Power" solenoids operate continuously in 25 cycle 110 or 220 volts as well as in 60 cycle service up to 550 volt. DC Silicone Insulation also assures efficient operation in spite of high ambient temperatures.

And Dow Corning Silicone electrical insulation gives you more power per pound in other kinds of electrical equipment including motors, transformers, and generators. For more information, call our nearest branch office or write for our new collection of case histories on Silicone Insulation, pamphlet No. G7-K-2.

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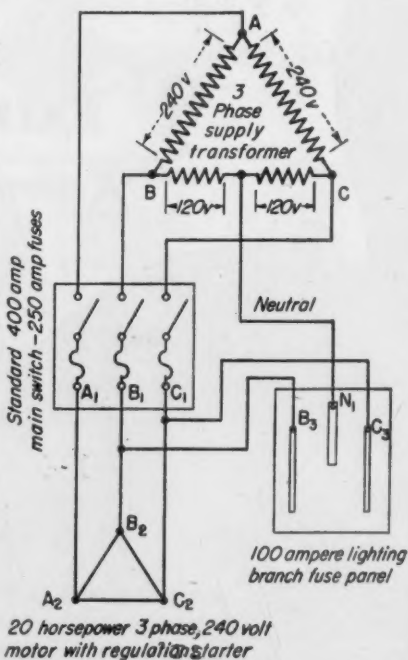
## Can you ANSWER these QUESTIONS

**QUESTION P14**—In a wye-connected 3 phase motor, when one leg of the winding is opened, only one of the two remaining legs will usually burn out. Why?—F.H.

**QUESTION Q14**—How do we find the correct size fusetron for a spot welder, so that we can use it at full rating and yet not burn it out?—H.S.

**QUESTION R14**—Here is a problem that authorities disagree on and I would like to get an answer. In rural areas many power companies supply a combination three phase load and a single phase load from a delta connected bank of transformers, as shown in the diagram. Often the lighting load is just connected on the load side of the main three phase fuses.

The problem develops when (for example) the main fuse  $B_1$  blows and disconnects the load from B phase of the service. When this happens the half of the lighting load from



$N_1$  to  $B_2$  is thrown in series with the motor winding  $A_2B_2$  and a circuit is completed from  $A_1$  to  $N$  at the transformer.

The question is: In this series circuit, will there be a detrimental de-arrangement of voltage dissipation which can force additional current through the lighting load and burn out equipment connected to the lighting circuits?—T. R. H.

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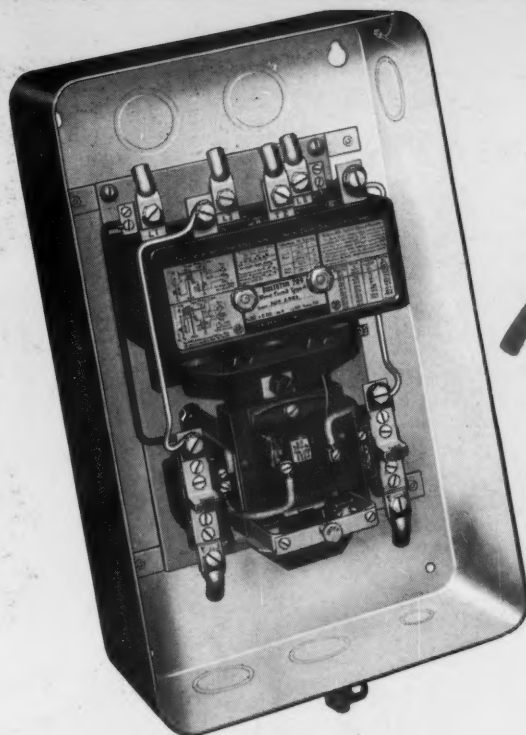
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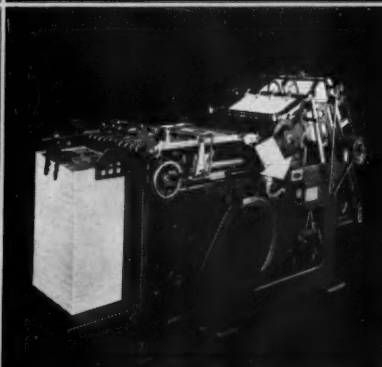
**VERSATILE** . . . that one word best describes the wide utility of the Allen-Bradley Bulletin 709 Solenoid Starter. Most motor installations need across-the-line starting . . . push-button control . . . and dependable overload protection. These features . . . and many more . . . are provided by all Bulletin 709 Solenoid Starters.

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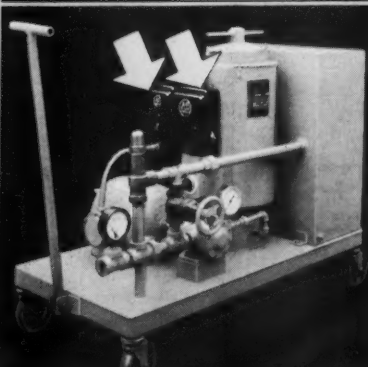
for MOBILE MOTORS



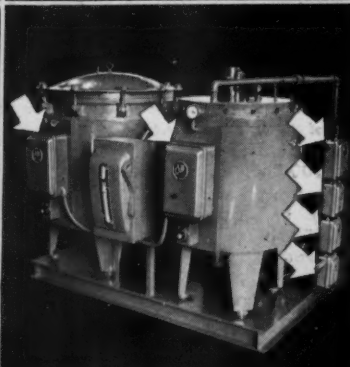
for PRINTING MACHINERY



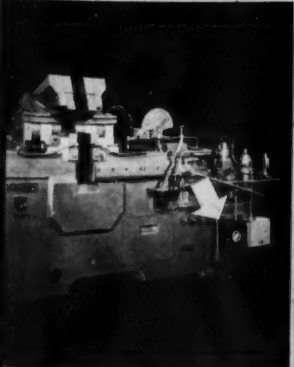
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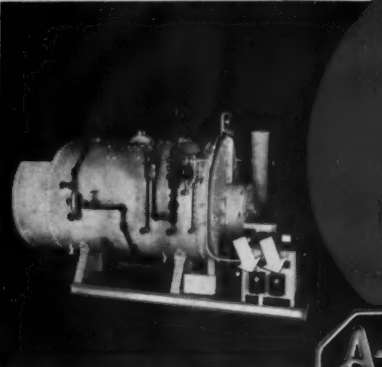
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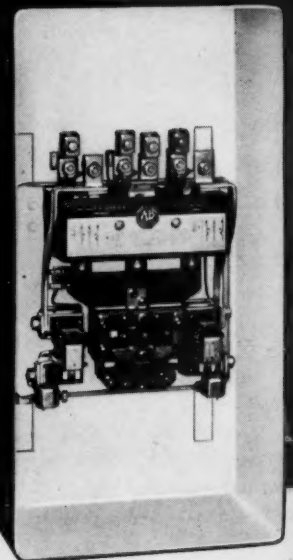
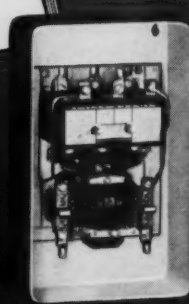
**ALLEN-BRADLEY**  
QUALITY  
**MOTOR CONTROL**



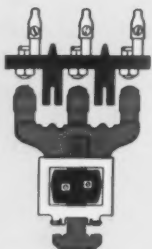
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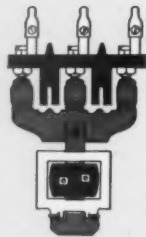
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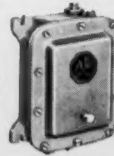
Dust-tight



Water-tight



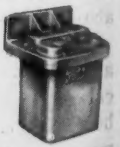
Hazardous Dust



Hazardous Gas



Non-Haz. Cor. Gas



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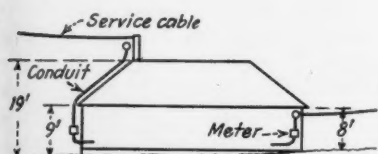
Answered by  
**F. N. M. SQUIRES**  
Chief Inspector  
New York Board of Fire Underwriters  
New York, N. Y.

and  
**GLEN ROWELL**  
Electrical Engineer  
Fire Underwriters Inspection Bureau  
Minneapolis, Minn.

# Questions on the Code

## Service Height and Grounding Problems

**Q.** I have two problems. The first concerns a service entrance using 4/3 service cable, all of which can be better described by a sketch as follows:



The Code requires that a service entrance cable must connect to a building 10 ft. or more above ground level. In the figure above, that is not possible. However, would it be possible to construct a mast at the peak of the roof which in this case is 19 ft. above ground and run conduit down the slope of the roof, through the eaves and down the outside wall to the meter box?

My second problem concerns the kitchen sink and bathroom sink fixtures. Is it necessary to run continuous ground conduits to these fixtures, and are pull chain switch controls acceptable?—G.M.D."

**A.** The last sentence of Section 2324 will permit that the attachment to a house may be less than 10 feet above the ground where the form of the building does not permit a height of 10 feet or more. In this case, the insulation on the service conductors must be of rubber or equivalent.

Also in this case a pole away from the house might have to be provided high enough to provide the 10 ft. clearance above sidewalks and 18 feet above driveways and roads.

While a mast, pole or post could be attached to the building or roof to increase the height of the wires, probably building restrictions or the Art Commission would not approve.

Second Part. If metal clad wiring is used, that automatically takes care of the grounding problem, but if the wiring system is not metal clad a grounding conductor (which may be a No. 14 wire), may be run from the metal frame of a fixture to the nearest

water pipe in order to ground the fixture.

Metal pull chains used at these locations shall be provided with insulating links (See Section 4215, last sentence).—F.N.M.S.

## More About Class II (Dusty) Locations

Mr. C. H. Bissell, Chief Engineer of the Crouse-Hinds Company and for many years a member of the Electrical Committee of the N.F.P.A., has very kindly furnished the following discussion on the use of Condulets in Dusty Locations.

We greatly appreciate Mr. Bissell's letter and his very welcome contribution to his clear elucidation of the problem.—F.N.M.S.

"In the January issue I noted a question regarding a dusty location by 'W.E.T.' This Inquirer's question was directed at Motors and Conduit Fittings, particularly at Section 5054, Paragraphs A-1 and a-2. He asked if ordinary condulets with gaskets, would be satisfactory. Your reply was that ordinary condulets were not suitable for dusty locations as such condulets are not dust-tight.

I fear this answer is too brief to be an adequate response to the question. It was the intent of Article 500 Committee to permit the use of non dust-tight boxes and fittings in locations where dusts were not electrically conductive, provided the boxes contained no arcing or sparking members. However, if the dusts were conductive then such boxes and fittings were to be dust-tight. All boxes containing arcing or sparking members, were required to be dust-tight regardless of the conductive nature of the dust.

Perhaps the committee (of which I am one), in an effort to be free, left too much to be deduced by the reader. Paragraph 5054 a-1 reads:

"Fittings and boxes used in locations where dusts are of an electrically conducting nature, shall be dust-tight."

This leaves the reader to infer that

if the dusts are not conductive, then the fittings and boxes need not be dust-tight. Such an inference would be in agreement with the intent of the Committee.

If the Inquirer had completely understood the above paragraph, then he might not have felt that there was an inconsistency between it and 5054 a-2. However, I do believe that he would have been justified in asking 'what kind of flexible connections are required if the dusts are conductive?' 5054 a-2 is silent on this point. I am calling it to our Chairman's attention. Obviously if because of conductive dusts, dust-tight boxes are required, the flexible connection should also be dust-tight.

I have no first hand knowledge regarding locations where sulphur dust creates a hazard but from the sources at hand it appears the location mentioned by 'W.E.T.', is Class 2, Division 1; therefore electrical equipment meeting the pertinent requirements, should be used. If, however, the location had been one wherein the sulphur had been heated to a degree where its vapors could have contaminated the air, then Class 1 Division 1 would have applied."

## Underground Service Cable

**Q.** Last summer we wired a number of new homes and used underground service cable from the pole on the alley to the buildings because they were all too low to provide proper clearance for overhead service. So far we have already had two trouble calls and have found the cables cut where they enter the conduit nipples extending through the basement walls. The cost of digging in frozen earth is rather excessive, yet we seem to be responsible. Why is such a cable approved if it cannot last through a single winter?—H.T.S.

**A.** There is nothing wrong with the approved type USE cables, the error was made by not including

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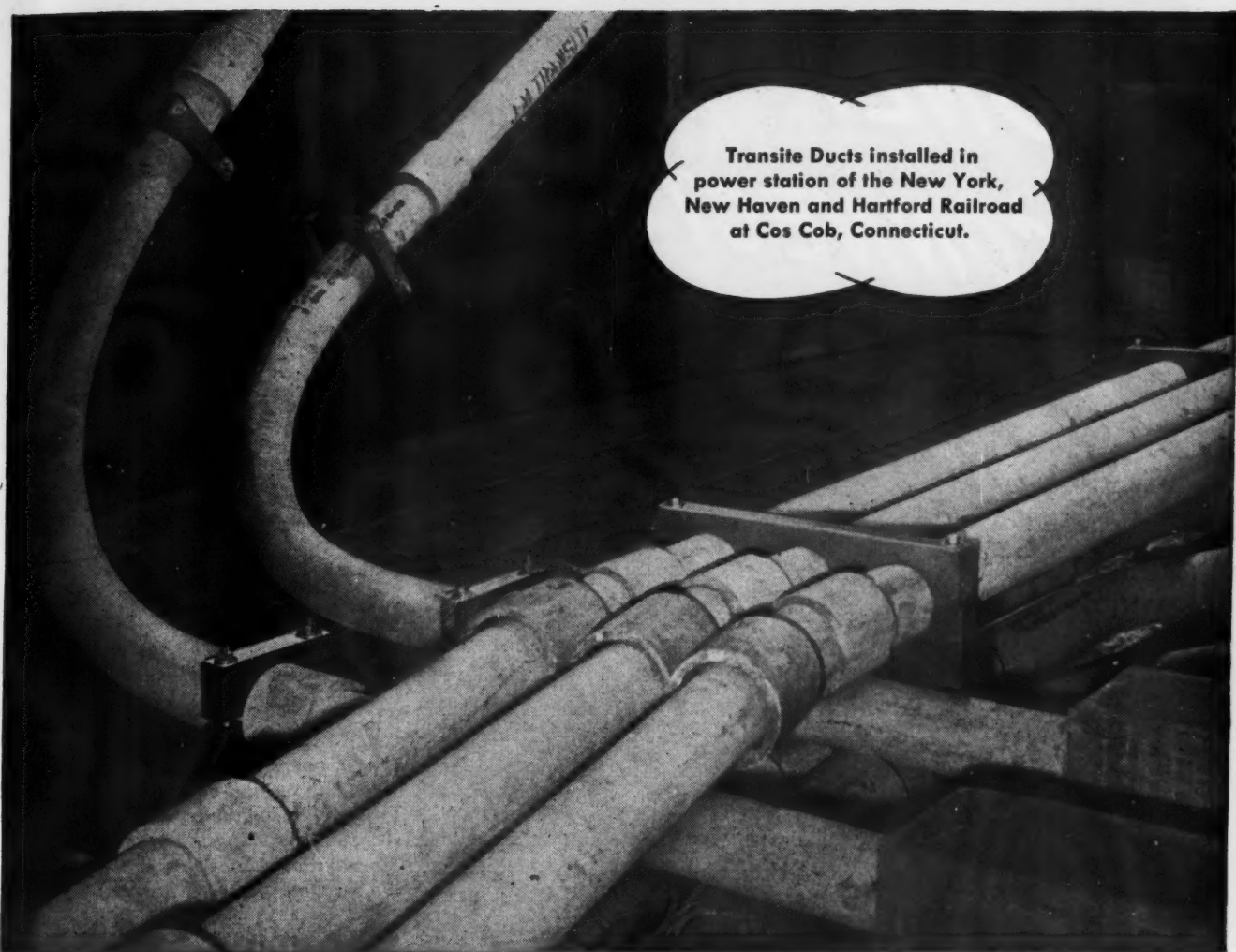
A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO.



installation requirements in the N. E. Code. Experience has shown that if properly installed, these new neoprene jacketed underground conductors and cable will last indefinitely. However, the following suggestions have to be complied with to assure trouble-free service:

1. Bury the cables sufficiently deep to assure no interference from normal conditions. On farm properties they should be at least 14 inches deep to keep them below ordinary plow depth. In cities they should be buried at least below spade depth in lawns and gardens unless they are so located that there is no likelihood of ordinary yard operations interfering with them. When passing under unpaved driveways, bury them at least 18 inches and place a creosoted plank on top of them for protection.
2. Where such conductors enter conduits fastened to building walls or pass through openings in masonry foundations, several inches of slack conductor should be looped in a vertical manner as the earth, when subjected to freezing temperature, heaves and falls. In climates where the ground is not frozen, this precaution probably is unnecessary. This heaving and falling of the earth creates sufficient stress on underground piping cables, etc. so even large water mains are often broken. Hence there is no reasonable means of providing rigid protection. However, a loop the width of your hand will provide adequate protection.
3. If the soil contains stones or rocks, a layer of sand or other finely divided earth two inches or more in thickness should be provided both under and over the conductors.
4. Never attempt to use a bare copper conductor for the neutral unless a soil analysis indicates that it is free of materials which will rapidly attack copper.
5. Whenever such conductors enter buildings through holes or conduits located below ground level, fill the hole or conduit after the service is in place with a sealing compound to prevent entry of moisture.
6. On farm properties locate a junction box at the meter loop location and feed the principal buildings from it. On other properties where more than a single building is being served, an accessible junction box will prove much more satisfactory than one buried underground should you be called back at some later time.

Recommendations No. 3 and 5 are now contained in the N. E. Code, but the others are not there as yet and some of them are most important.—G.R.



Transite Ducts installed in  
power station of the New York,  
New Haven and Hartford Railroad  
at Cos Cob, Connecticut.

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Transite\* Ducts were chosen for the important job of protecting the power lines in the New Haven's Central Power Station at Cos Cob because they meet every requirement of a low-cost efficient cableway system.

*These asbestos-cement ducts provide 5 major advantages:*

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\*Reg. U. S. Pat. Off.

3. Immune to Electrolysis—Entirely inorganic and non-metallic, Transite Ducts are immune to electrolytic or galvanic action.

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### TRANSITE DUCTS



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No matter what size or type you specify, you'll find each fitting fits like a glove. Clean threading, smooth finish and real locknuts on all connectors mean all Gedney fittings install quicker and easier... assure permanent installations that can't shake loose. For convenience when ordering, the entire line is included in a carefully arranged, bound catalog. Write for your copy today on company letterhead please.



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FOUNDRY, FACTORY AND SHIPPING POINT: TERRYVILLE, CONN.

A COMPLETE LINE OF FITTINGS FOR RIGID CONDUIT, EMT  
ARMORED CABLE AND NON-METALLIC CABLE

## Splices, Service Wires, Mixed Conductors

**Q.** 1—Are splices allowed in condulets as in LB Condulets or taps in T Condulets?—L.E.V.

**A.** 1—Splices are permitted in condulets and similar fittings of other manufacturers.—F.N.M.S.

**Q.** 2—Is there a limit to the length of service conductor from the weatherhead to meter, and from the meter to the main disconnect switch other than to correct for voltage drop?—L.E.V.

**A.** 2—There are no limitations in the Code governing the length of service wires.

However, the service equipment must be at the nearest readily accessible point to where the service conductors enter the building. This is not intended to permit any great length of run of service conduit within the building.—F.N.M.S.

**Q.** 3—Are lighting circuit conductors allowed to run in the same conduit serving convenience outlets in Industrial buildings? Are light circuit conductors allowed to run in the same conduit as a 230 volt welding circuit in a machine shop?—L.E.V.

**A.** 3—The answer to both parts of this question is "Yes". See Section 3011.—F.N.M.S.

## Thermoplastic Wire vs. Lead Covered Wire

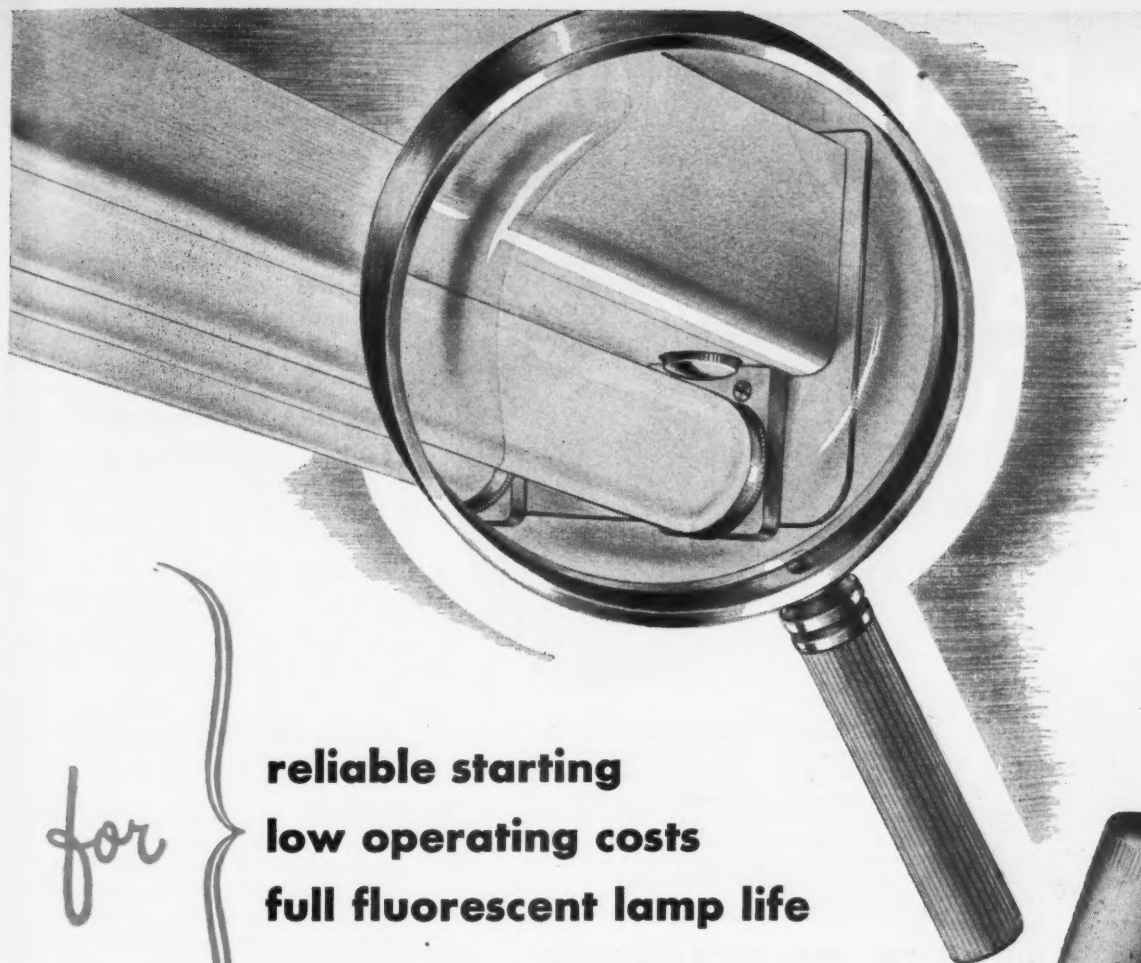
**Q.** "Is it possible to use T. W. (thermoplastic) wire in conduits from buildings to dispensing islands?"

In Article 500, Section 5142, it states lead must be used in the pumps, but fails to include island light poles, located in the same island.

Is it possible to run T.W. wire from building to explosion-proof conduit installed on island light pole, and from this point run lead cable to dispensing pumps.—S.E.F.

**A.** The Underwriters Laboratories' Listings of thermoplastic covered wires do not include an approval for the use of thermoplastic wires where exposed to gasoline.

However, with the present practical impossibility of obtaining lead covered wires and in view of the fact that thermoplastic insulation of some grades are not very susceptible to the actions of gasoline, the thermoplastic wires are being used in and about gasoline sta-



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**reliable starting**  
**low operating costs**  
**full fluorescent lamp life**

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**2116 KEITH BUILDING • CLEVELAND 15, OHIO**

# New POSITIVE LOCK Construction of Monarch Renewable Fuses

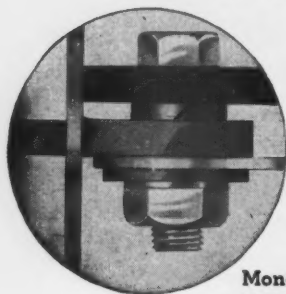
Assures →  
TRUE ALIGNMENT



The brass lugs inside the caps used on Monarch Fuses (see illustration at right above) fit into equally spaced slots in the brass casing inserts. This new and improved Monarch construction assures true alignment of the copper holding terminals . . . and establishes a positive lock on both ends of the fuse.

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**STILL GREATER PROTECTION . . .**



**MONARCH'S Compressed Tension Lock Washer** construction (illustrated at left) compensates for contraction and expansion of the fibre bar by exerting constant tension on the bar . . . and assures no loose parts. The washer also separates the fibre bar from the copper terminals . . . a spacer to provide better cooling.

Monarch Fuses are fully approved and are available through recognized wholesalers.

*Specify Monarch Fuses  
for improved*



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**MONARCH FUSE CO., LTD.**  
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**N. Y.**

tions. Where it is used in these locations, the conduit should be very tightly made up so as to prevent the possibility of gasoline getting into it.

Note that Section 5142 would permit the use of a thermoplastic insulation upon which gasoline would not have a deleterious effect. This would not have to be lead sheathed.

Where Section 5142d mentions dispensing pumps, it does not include in that the island light poles.—F.N.M.S.

## Official Interpretations

**Section 4150.** Interpretation No. 287. Issued February 21, 1947. Single Branch Circuit in Fixture Used as Raceway.

**Question:** Does the expression "single branch circuit" in section 4150 of the 1947 edition of the National Electrical Code limit the application of this section to a two-wire branch circuit—

**Finding:** No.

**Section 6216.** Interpretation No. 281. Issued December 2, 1946. Lighting and Signal Circuits Separate.

**Question:** Does section 6216 of the 1940 and the 1947 editions of the National Electrical Code forbid assembling the conductors of car lighting circuits and of signal systems in a common traveling cable when the various applicable provisions of section 6217 are satisfied?

**Finding:** No.

**Section 3102.** Interpretation No. 282. Issued December 31, 1946. Type "T" Wire.

**Question:** Was it the intent of the Electrical Committee in the Classification of Type T insulation, table of section 3102, as acceptable for general use, to permit its substitution for Type R wire, if desired, as an individual conductor for a service drop, in addition to Type WP?

**Finding:** Yes.

**Tables 1, 2, 4, and 9.** Interpretation No. 283. Issued December 31, 1946. Number of Signal Wires in One Conduit. Reduced Carrying Capacity Where Control Wires Are in Same Conduit With Power Wires.

**Question 1:** Is it the intent to limit the application of Table 9 of the 1947 edition of the National Electrical Code to the particular use mentioned in the note following the Table, providing when more than 9 conductors are installed in a single raceway the purpose and intent of section 3012 are satisfied?

**Finding:** No.

**Question 2:** May Table 9 of the 1947 edition of the National Electrical Code be applied in the installation of conductors for low-energy power and circuits of Class I signal systems?

**Finding:** Yes.

[Continued on page 187]





**HERE'S A TYPICAL TEST**

**ONE OF 486**

**THAT WESTINGHOUSE FLUORESCENT LAMPS PASS**

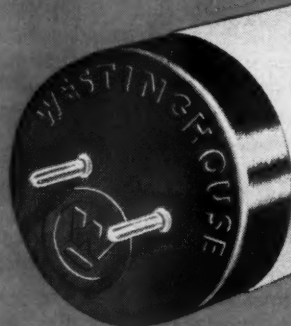
A phosphor crystal functions at top efficiency in a fluorescent lamp when its atoms are united in a definite pattern. Here a Westinghouse scientist tests mixtures of new phosphors in the Research Laboratory at Bloomfield, New Jersey.

**That's Why Westinghouse Fluorescent Lamps**

**WORK SO WELL**

**BURN SO BRIGHT**

**LAST SO LONG**



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159

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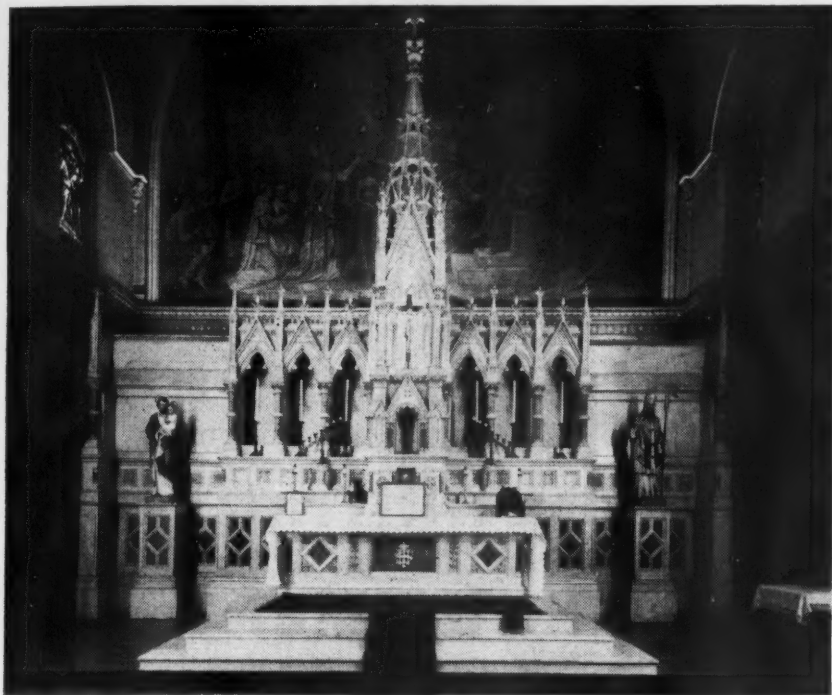
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# Modern Lighting



*Fluorescent reflectors, projector spots, and reflector spots and floods are used to place emphasis on the rich beauty of design and craftsmanship in the altar area of Saint Patrick's Church, Roxbury, Massachusetts.*

## Effective Altar Lighting With Standard Fixtures

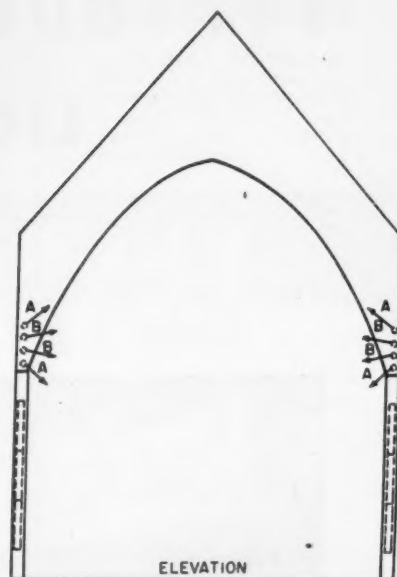
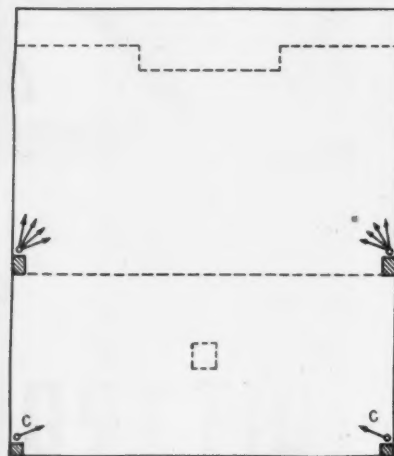
The delicate craftsmanship which is prevalent in so many of our sanctuaries is often overlooked due to insufficient illumination. Sculpture, paintings, exquisite woodwork and creations in stone, representing important investments, are quite frequently unappreciated because of a lack of relatively inexpensive lighting installations. When the intangible value of sacred tradition is considered in addition, even the more elaborate lighting plans seem justified, yet effective altar lighting need not be elaborate, and dramatic settings can be created by the use of standard fixtures.

Saint Patrick's Church in Roxbury, Massachusetts, definitely illustrates this thesis. Planned by C. A. Russell, lighting consultant for the Boston Edison Company, and installed by the J. J. Reddington Electric Service Company of Roxbury, the layout includes projector and reflector spotlights, reflector floods and standard fluorescent fixtures. Concealing the units behind columns, arches and ledges, and carefully focussing reflec-

tors so that light patterns are smoothly blended together, the rich beauty of the altar is emphasized without the creation of distracting highlights or disturbing shadows.

With the exception of projector spotlights which are mounted on forward columns and focussed on the pulpit, all units are positioned behind the arch which frames the altar. Mounted vertically behind the two framing columns, three 3-lamp 40-watt fluorescent RLM reflectors, utilizing 3000-degree white lamps, are positioned end-to-end to produce an even, soft, general illumination for the entire area. Directly above these fluorescent installations, mounted above the columns at the bases for the arch, 150-watt incandescent flood and spot lamps are so positioned and focussed that special features of architecture and decoration are given emphasis.

With multi-directional light coming from two directions and several elevations, shadows are softened and gradually blend from the highlighted surfaces to the deeper indentations of the scul-



- Use reflector trough with 40 watt 3000° fluorescent lamps—conceal behind column
- A → Use adjustable unit with 1-150 watt reflector flood lamp—mount on arch as shown in elevation plan
- B → Use adjustable unit with 1-150 watt reflector spot lamp—mount on arch as shown in elevation plan
- C → Use adjustable unit with 1-150 watt projector spot lamp—mount on ledge at top of column

**Standard lighting units, specified by C. A. Russell of the Boston Edison Company and installed by the J. J. Reddington Electric Service Company, are concealed behind columns, arches and ledges.**

ture and rich wood carvings. Eyes of worshippers are drawn to the sanctuary and can appreciate the beauty of the physical as well as the spiritual presentation. By this relatively modest investment in lighting equipment, an entirely new value has been placed upon the richness of this religious setting.



# Planned

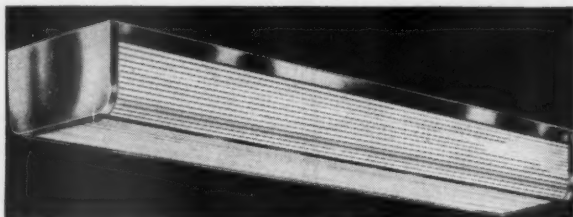
## LIGHTING INSTALLATIONS

CAN BE PROFITABLE *with*

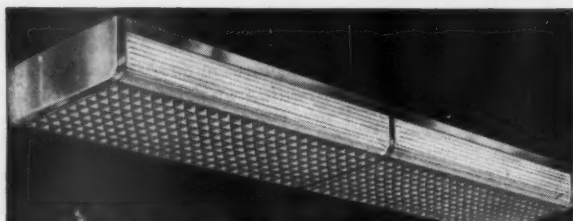
# PITTSBURGH PERMAFLECTOR

## LIGHTING EQUIPMENT

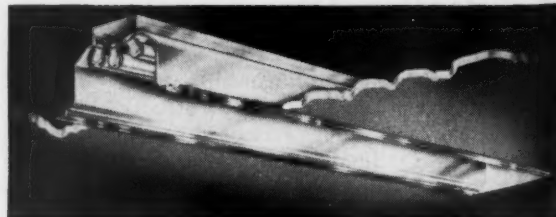
## FLUORESCENT LIGHTING



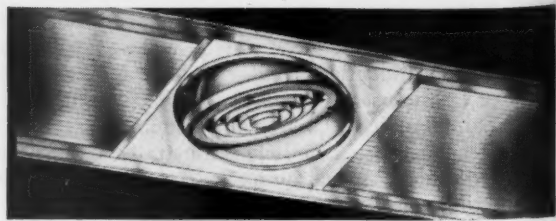
THE "GRANT" LUMINAIRE is typical of the Pittsburgh Permaflexor Presidential Luminaires available in 2, 3 and 4-lamp models for surface or pendant mounting, individually and in continuous row. Flexible in application, these units are particularly suitable for store and office lighting and other applications where appearance is paramount and facility of maintenance is desired. Companion incandescent equipment is obtainable for use with this series.



THE "WASHINGTON" SLIMLINE LUMINAIRE is one of the 96" Presidential Series units for surface or pendant mounting, individually or in continuous row. When surface mounted the "bridge-truss" chassis construction insures snug ceiling fit and results in a "built-in" look. These units are available in 3 and 4-lamp models with 200-MA ballasts. Companion incandescent units are also obtainable for use with this series.

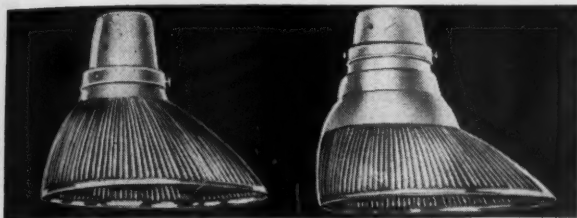


THE "UNIVERSAL" TROFFER is a completely flexible unit which may be ceiling recessed individually, in continuous rows, patterns, squares and other arrangements to suit the requirements of the user. The basic "Universal" troffer-chassis can be used as an open type troffer but it can also quickly and easily be equipped with any of the following shielding accessories: egg-crate louver, Alba-Lite glass panel, baffle-louvers or lens panels.



THE "200" SERIES ADJUSTABLE DOWNLITE is typical of the companion incandescent units designed for use with Pittsburgh Permaflexor Fluorescent Equipment when "accent" or spotlighting is desired. The downlight illustrated rotates in a complete circle and fixes at any position up to 30° from its vertical axis; it is used in end, in-line, cross-over, corner and "T" arrangements with troffer installations.

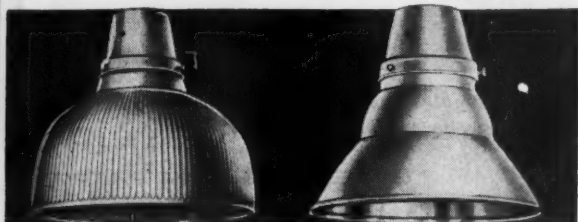
# INCANDESCENT LIGHTING



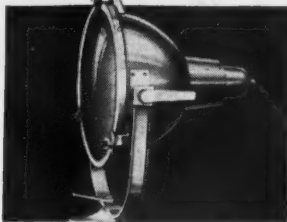
**SHOW-WINDOW PERMAFLECTORS**, the permanently efficient silvered glass reflectors backed by a ten year guarantee, are available in various combinations for lighting shallow, island, medium and deep windows of low, medium or high ceiling heights. The flexibility of Permaflexor Show-Window Equipment permits many varied arrangements . . . all of which can be easily and quickly achieved with the standard units.



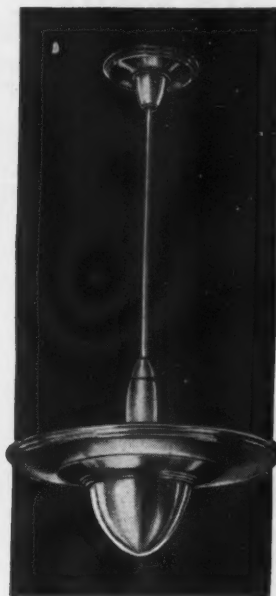
**HIGH-BAY INDUSTRIAL UNITS**, in enclosed or open types utilizing incandescent and/or mercury vapor lamps, are designed especially for high-bay lighting, gyms and similar applications.



**CEILING RECESSED PERMAFLECTORS** of broad or concentrated distribution for all types of mounting arrangements and for every interior lighting application are part of the standard Pittsburgh Permaflexor Incandescent line. Combinations are available for external mounting, as well as recessed ceiling installations. A wide variety of accessories meets the specific illuminating requirements of any and all types of interiors.



**WEATHER-PROOF FLOODLIGHTS** of rugged aluminum construction are available in 200-W to 1000-W units. Precision engineering assures dependable illuminating results.



**INCANDESCENT LUMINAIRES** for direct or indirect lighting with direct component, are in the standard line. Units have spun aluminum housings and silvered-glass Permaflexors.

## *"There Is a Permaflexor for Every Purpose"*

When you sell Pittsburgh Permaflexor Lighting Equipment you offer your customers the correct fluorescent and incandescent units—or combination of both—they need for producing the *exact* illumination required in all their applications. The Pittsburgh Permaflexor line is the *only* complete line that meets every need.

"Planned Lighting" becomes a simple matter, quickly and easily obtained, through the use of standard Pittsburgh Permaflexor Units . . . for this flexible incandescent and fluorescent equipment can be combined to achieve the visual and architectural results needed in each individual installation.

For full information about the completeness of the line, the many selling features and the broad profit possibilities in Pittsburgh Permaflexor Equipment—write the home office. If you haven't the new Fluorescent Catalog 48-F or Incandescent Catalog 46, request it on your letterhead.



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**NEW!**  
**Aluminum-Alloy**  
**"UP-RIGHT"**  
**SCAFFOLDS**  
 MOBILE 45' UNIT TAKES  
 ONLY 15 MINUTES TO ERECT



Electrical work by Interstate Electric Co. in Trinity Church, Springfield, Massachusetts.

Rolls easily from position to position. Bridges obstacles with ease. A 7 foot, single section unit requires one man only a minute to erect; a 45 foot multiple unit only 15 minutes. Stronger than structural steel yet one-third the weight. Safety-tread stairway completely within the structure. No wrenches, wing nuts, bolts, loose parts. Each section folds flat.

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## UP-RIGHT SCAFFOLDS

ROOM 107 - 1013 PARDEE ST.

BERKELEY, CALIFORNIA

Offices in All Principal Cities



Modern, carefully planned lighting creates cheerful interior and accents the merchandise in Van Sipma Bros. jewelry store, Chicago, Ill.

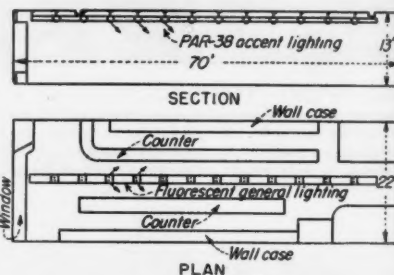
## Jewelry Store Uses Dual Lighting

Two-purpose lighting has been installed in the Van Sipma Brothers Jewelry Company store, 11114 South Michigan Avenue, Chicago, Illinois. This is accomplished with a continuous row ceiling suspended luminaire which combines 13 four 40 watt fluorescent units, alternating with twelve twin spotlight units each using two 150-watt PAR-38 incandescent lamps. Wall cases are lighted separately by a continuous row of concealed fluorescent lamps.

This store is 70 feet long, 22 feet wide, and has a 13 foot ceiling height. The light colored ceiling has a reflection factor of 76 percent, and the side walls have a 65 percent reflection factor. The floor is also light in color, with a 35 percent reflection factor. The showcases and wall cases are mahogany. Mirrors are used for backs in the wall cases, and shelves are clear glass. The store fixtures are symmetrically arranged along the axis of the store, with wall cases installed on both longitudinal walls, and with show cases running the length of the store.

The solution to the lighting problem involved is very simple and effective. The single continuous row unit is installed down the center axis of the store, and suspended approximately 18 inches from the ceiling. Thus, the ceiling is lighted softly, which adds apparent height to the store and provides a pleasing luminous background for the lighted luminaire, minimizing objectionable brightness contrast.

General lighting is obtained from fluorescent units—an intensity of 70 footcandles is obtained at counter



Section and plan shows location of lighting equipment in relation to counters and wall cases in Chicago jewelry store.

height directly under the units, and of 50 footcandles at the center of the counter tops. These units are of the "low brightness" type, having ceramic coated glass side panels with a brightness of only .75 candlepower per square inch. The bottom of the units is eggcrate louvered, and has a 45-degree by 45-degree cutoff. As a result of this low brightness design, these units are comfortable to look at and are not bright enough to detract attention away from the merchandise on display.

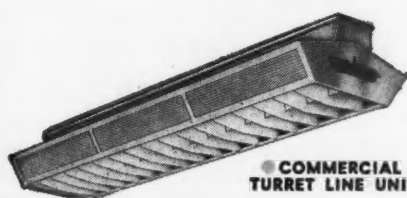
Accent lighting is superimposed on the general lighting, to highlight the merchandise displayed in the floor and wall cases. This lighting is accomplished with gimbaled twin reflector spot units installed alternately with the fluorescent units. Type PAR-38 lamps are used in these adjustable twin lamp units, and directed diagonally down to the showcases and to the rear of the store. This places a high intensity of point-source incandescent light on the jewelry and merchandise displayed in the cases. The intensity averages about 250 footcandles, and provides an excellent display effect. Gems



● New Wheeler 5-Inch Turret Socket Fixture for two or three 40-watt lamps. Open or closed end, double or single length.

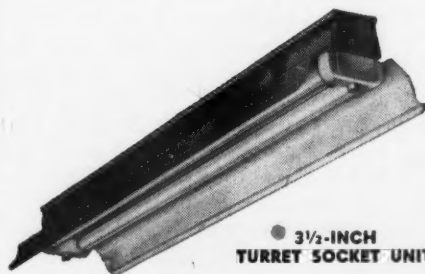
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● COMMERCIAL  
TURRET LINE UNITS

An improved commercial fluorescent fixture for offices, stores, hospitals, schools, public buildings. Special top shield eliminates "hot spot" on ceiling... one-piece, hinged lower body cuts glare in line of vision. For two 40-watt lamps...  $3\frac{1}{2}$ " lamp spacing.



●  $3\frac{1}{2}$ -INCH  
TURRET SOCKET UNIT

New Wheeler RLM Fixture for locations where compact size and lighter weight are desirable. Scientifically designed, ruggedly built and finished with Wheeler Triple-Guard Vitreous Porcelain Enamel. For two 40-watt lamps... individual or continuous runs.

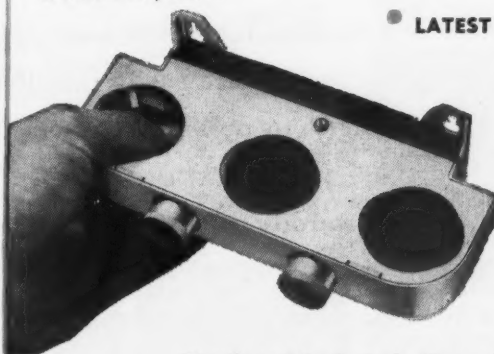
● The addition of new RLM Turret\* Socket Fixtures with 5-inch lamp spacing to the Wheeler Turret Line, now makes "Skilled Lighting" available in this most modern, efficient type of fixture for any industrial lighting requirement.

The new Wheeler 5-Inch Turret Line Units are designed to dimensions that afford uniformity in installation with previous Wheeler Units. Made for two and three 40-watt lamps... in single or double length... with open or closed end reflectors... for all standard suspensions... individual or continuous runs. Finished in Wheeler Vitreous Porcelain Enamel.

Like other fixtures in the Wheeler Turret Line, this new unit has the new G.E. Turret Lampholders. No socket breakage... no falling lamps... speedy relamping... vibration-proof.

Before you specify fluorescent fixtures for any installation, get full information on the new, improved Wheeler Turret Line. Write the WHEELER REFLECTOR CO., 275 Congress Street, Boston 10, Mass.

### ● LATEST TYPE LAMPHOLDERS



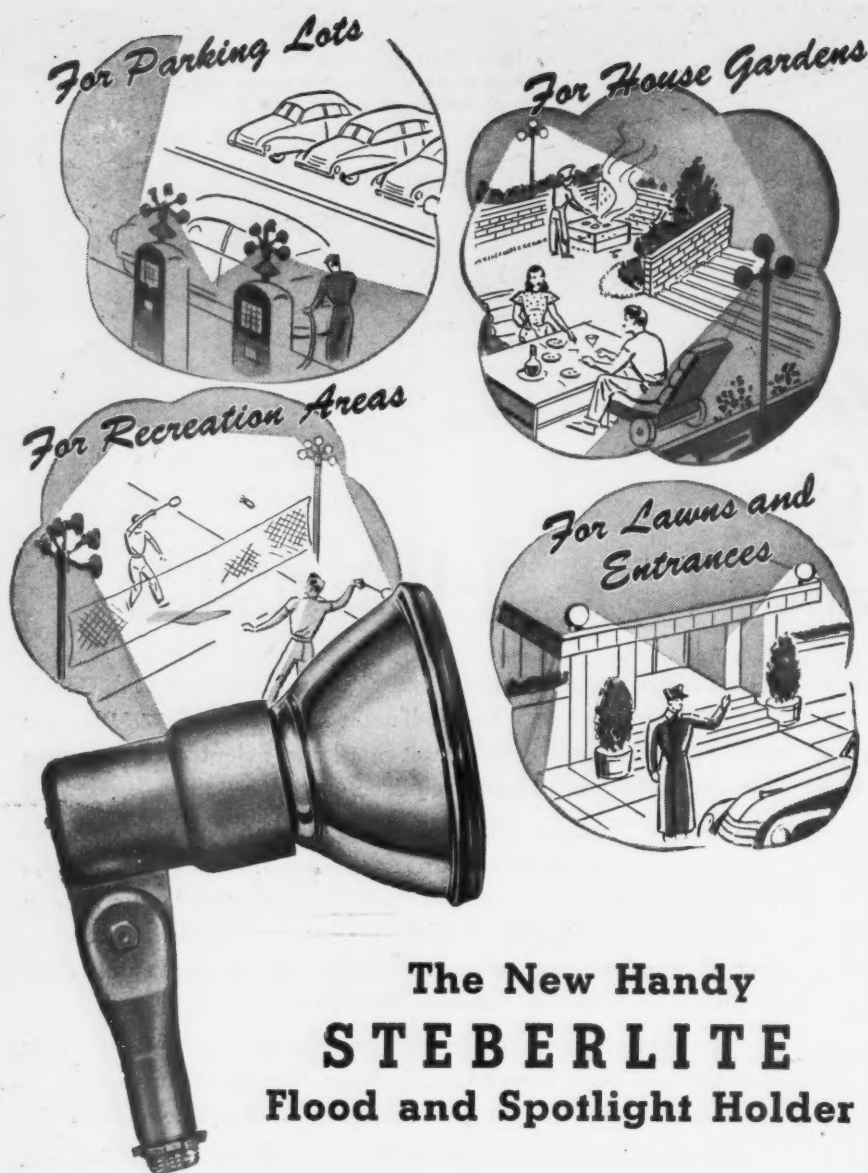
An outstanding feature of all Wheeler Turret Line Units is the new G.E. Turret Lampholder. Insures constant spring tension. Saves money and maintenance. No socket breakage... no falling lamps... speedy relamping... vibration-proof.

Distributed Exclusively Through Electrical Wholesalers

**Wheeler** REFLECTORS  
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## The New Handy STEBERLITE Flood and Spotlight Holder

For Parking Lots, Gas Stations, Recreation Areas, and House Gardens, the Steberlite lamp holder—for 150 Watt Par-38 and R-40 lamps is a flexible inexpensive method of spot and flood-lighting. Steberlites are easily installed anywhere and can be used singly, in pairs, or clusters of 3, 4 and 5.

They are smartly styled and sturdily constructed with all wiring concealed for long life and complete safety. Steberlites make it possible to have good, effective lighting at a surprisingly low cost. Let us mail you a copy of new Bulletin 120. It contains many helpful lighting hints.



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new  
Bulletin 120

# STEBER

## LIGHTING UNITS

STEBER MANUFACTURING CO. Dept. 70  
2700 ROOSEVELT ROAD, BROADVIEW (MAYWOOD P. O.), ILLINOIS

and precious stones unobtrusively become alive with sparkle, so that the customers' attention is subtly focused to the items on display. The location of the spots is such that no objectionable reflected images are present, and the units are completely inconspicuous.

The wall cases are illuminated by a continuous row of 40-watt fluorescent lamps concealed back of the wall case headings. The glass shelves permit illumination of the entire cases from the single line of lamps.

The color quality of the resultant illumination is ideal for jewelry store lighting, in the opinion of the store management. The warm tone of the incandescent accent lighting is tempered with the cool tone of the 4500-degree white fluorescent lamps. The well lighted mirror-backed wall cases help in creating a feeling of uncluttered spaciousness in this bright and cheerful interior.

Sluis Electric Company, Chicago, Ill. were consultants and electrical contractors on this jewelry store lighting installation. All lighting equipment used was manufactured by Lighting Products, Inc., Highland Park, Illinois.

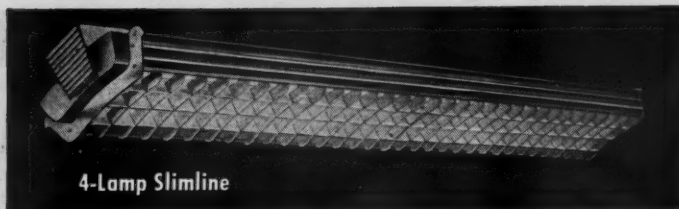
## Lighting for Cloth Inspection

Final examination of finished worsted and woolen textiles has been made easy at Uxbridge Worsted Company, Inc., Uxbridge, Mass. This has been made possible by providing daylight quality illumination ranging from 300 to 400 footcandles on the perch-boards across which the finished cloth is pulled for inspection.

Each examining perch hangs from a framework suspended from the ceiling. The perch-board is slanted at an angle of ten degrees from the vertical. Each perch-board is 6 ft. 6 in. wide and 3 ft. 9 in. in height. These boards are installed with the bottom of the board 4 ft. 2 in. above the floor, which places the bottom edge about 15 to 21 inches above the eye-level of the average examiner.

The color and finish of exposed areas in the inspection room have been carefully selected to provide maximum eye-comfort and minimum color distortion for the examiners. The perch-boards are painted a neutral tone light grey, and the ceiling and upper framework from which the boards are suspended are finished semi-gloss white. The surrounding walls, from a line 15 inches above the floor to the ceiling, are finished in a light eye-rest green. The lower wall area up to the line 15 inches above the floor is finished deep apple green.

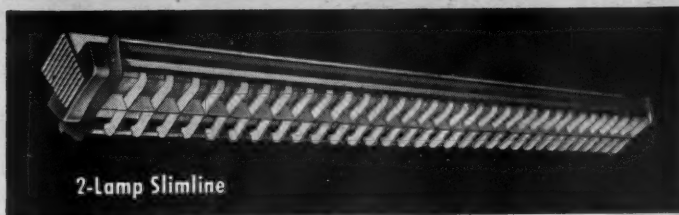




4-Lamp Slimline



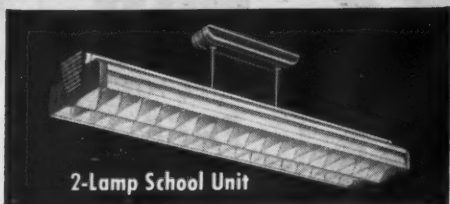
Troffer System



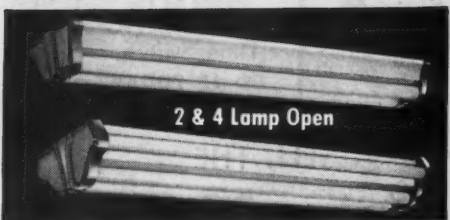
2-Lamp Slimline



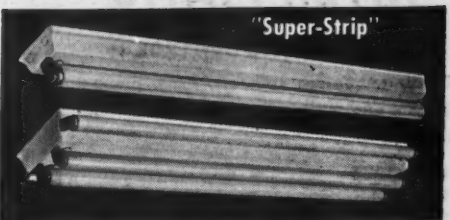
"Wafer Thin"



2-Lamp School Unit



2 & 4 Lamp Open



"Super-Strip"



"Twin Turret" Industrial



Spot-Rays



Spotlights



"Zoomlights"



Typewriter Desk Lamp



"Lullaby"  
Bedlamp Radio



Sun &  
Heat Lamps

# NOW OVER 150 MODELS

## in the MITCHELL

### COMPLETE LIGHTING LINE!

Build your lighting business profitably around the one complete line that covers your entire market. The MITCHELL Line—now well over the 150-model mark—is the most complete and diversified in the industry. This progressive development of "in demand" preferred quality merchandise, priced for profitable volume sales, gives you a powerful selling "edge." Here are your MITCHELL merchandising advantages:

1. Everything you need from one source
2. An ever-growing line that helps you grow
3. Strong acceptance in the lighting field
4. High saleability — competitive price  
— Guaranteed standards of quality

It's good business to concentrate your selling program around MITCHELL—the complete lighting line that builds solid business and bigger sales for you.

## YOU'LL SELL THEM ALL

WRITE FOR FULL CATALOG AND DETAILS



**Mitchell Manufacturing Company**

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**First Choice in Lighting • The Pioneer Line that Keeps Growing**



# You can INCREASE YOUR TIME SWITCH SALES NOW

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**FREE**

"Plan for more Sales"  
including full information on the  
**INTER-MATIC**  
Time Switch.  
**DO IT TODAY**

## SELL THE **INTER-MATIC**

for AUTOMATIC CONTROL of  
lighting, heating systems, fans, pumps,  
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- STORES
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- APARTMENT BUILDINGS
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Hundreds of electrical contractors throughout the country are already carrying out our suggested "PLAN FOR MORE SALES". Their orders prove that the plan can help you increase your own sales!



ONLY  
**\$10<sup>95</sup>**  
LIST  
F.O.B.  
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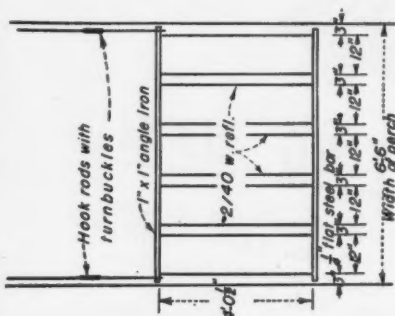
**International Register Co.**

2624 W. Washington Blvd.  
Dept. 39-B, Chicago 12, Ill.

**INTER-MATIC**  
TIME SWITCH



Special perch lights provide ideal inspection illumination of 300 to 400 footcandles on perch-boards in Uxbridge Worsted Company, Inc., plant, Uxbridge, Mass.

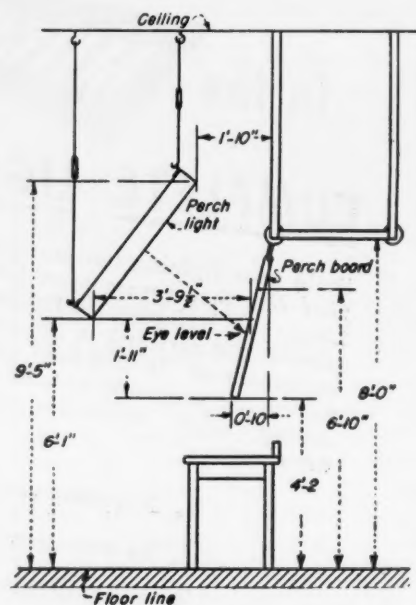


Recommended location for 10/40 watt fluorescent lamp perch light with relation to finished goods perch-board.

Cloth which is inspected on these boards varies from 56 to 60 inches in width. To inspect the cloth, the examiner places a folded pile of cloth to be inspected on a platform at the rear of the board. The cloth is then pulled up over a roll at the rear of the ceiling mounted supporting frame, horizontally through the frame, over a front top roll, and then vertically down over the face of the perch-board. As the examiner inspects the cloth, it is pulled down either by hand or automatically and folded in a pile below the front edge of the board. The examiner looks for all types of imperfections, such as wrong colors of yarns, off shades, spots, mistakes in pattern, or other weaving imperfections.

Both general illumination and specific high intensity inspection lighting are provided in the inspection room. General illumination is provided by continuous row closed end industrial fluorescent reflectors, with the rows spaced eleven feet apart, and installed 10 feet 6 inches above the floor. An intensity of 35 to 40 footcandles of uniform general lighting results.

Inspection lighting is provided on each perch-board by means of a special perch light, one to each board.



Spacing details of individual polished Alzak reflectors in perch light.

This special perch light is 4 ft.  $\frac{1}{2}$  inch high by 6 ft. 6 in. wide, and contains five specular finished Alzak aluminum reflectors mounted vertically in the rigid perch light frame. Each reflector is twelve inches wide, and equipped with 2/40 watt fluorescent daylight lamps. The perch light is installed in front of the perch-board at an angle and at such height that a line drawn normal to the center of the perch light hits the perch-board at the eye-level of the examiner, who stands facing the perch-board with the light at his back when inspecting the cloth. An intensity of daylight quality illumination varying from 300 footcandles at the outside edges of the board to 400 footcandles at the center and top of the board results.

Uxbridge Worsted Company maintains a rigid maintenance schedule on all perch lights.

# It's ONE to FIVE

FOR THE MOST SIMPLE  
... MOST FLEXIBLE  
FLUORESCENT LIGHTING

INSTALLATION



## WIREMOLD 21A SERIES 15 Watt fluorescent UNITS

Smartly-designed, compact, ready-wired . . . Wiremold 21A Fluorescent Units are ideally suited to meet the lighting needs of a wide range of commercial and industrial applications. Available as single lamp units . . . or for two, three, four and five lamps.

All units quickly, easily installed in horizontal or vertical position . . . clips furnished for permanent or portable mounting. Finished in sparkling white . . . may be used with or without reflectors. Ballast enclosed in channel.

No matter how simple or complex your problem . . . whether it's a matter of supplementary lighting or the installation of a complete system . . . check into the profit-building possibilities of Wiremold Fluorescent Units.

Today: write for complete information

**THE WIREMOLD COMPANY**  
HARTFORD 10, CONN.

*For use in . . .*

WORKSHOPS  
LABORATORIES  
STORES  
RESTAURANTS  
GARAGES  
OFFICES  
FACTORIES



**21AR** SERIES

Similar to the 21A series . . . with single and multiple units . . . but equipped with reflectors and end caps. Finished in golden bronze. Ideal for showcases, counter displays, wall cases, display boards, etc.

STOCK ORDERS PROMPTLY FILLED

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . MARCH, 1949

# TRIANGLE'S NEWLY EXPANDED CONDUIT PLANT



**Triangle Rigid Steel Conduit** finish is hot dip galvanized, uniformly both inside and outside, with additional protection assured by a baked-on coat of specially prepared linseed oil base lacquer. Available in sizes from 1/2 to 6 inches, with couplings and elbows to fit.

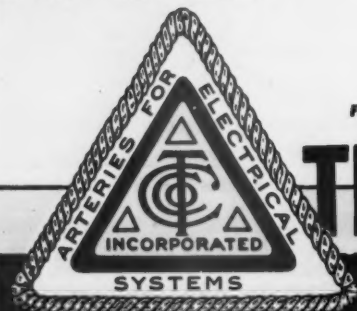
**Triangle Electric Metallic Thin Wall Conduit** is welded from high grade steel strip, insuring a perfectly true tube of uniform thickness and strength. Hot dip galvanized uniformly both inside as well as outside. Threadless. Available in 1/2 through 2 inch sizes.

**N**ow your requirements for rigid steel and thin wall conduit can be met faster, more dependably, since Triangle's newly expanded plant is in production. Located in Moundsville, W. Va., hard by the steel center of Wheeling, this enlarged manufacturing establishment incorporates latest advancements in production equipment to assure greater output and the uniformly high quality for which Triangle has been famous for over 30 years.

While output of steel conduit is at present limited by circumstances beyond Triangle's control, when these conditions change you can count on Triangle for an immediate increase in shipments. If there's a bottleneck in steel conduit, it won't be in Triangle's new Moundsville plant!

For *Extra* quality — at NO extra cost — insist on TRIANGLE!

## NOW SERVES YOU Better, Faster!



If It Bears This Trade Mark



It's Made by Triangle...

If It's Made by Triangle IT MUST BE RIGHT!

For latest information on deliveries, contact your nearest Triangle distributor or representative, or write

### TRIANGLE CONDUIT & CABLE CO., INC.

1908 Jersey Avenue, New Brunswick, N. J.

IT MUST BE RIGHT!

BUILDING WIRE • BARE WIRE • ARMORED CABLE • "GLAZON" TRIEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE, SERVICE DROP, VARNISHED CAMBRIC BRAIDED OR LEADED, TRIOPRENE TRENCH, POWER AND PARKWAY CABLES RIGID CONDUIT • ELECTRIC METALLIC THIN WALL CONDUIT • FLEXIBLE STEEL CONDUIT



# In the News

## Cite Need for Reinspection Program

Improper electrical wiring too often causes serious fire losses, Illinois electrical inspectors were told at the annual meeting of the Illinois Chapter, I.A.E.I., in Chicago's Hotel Sherman, January 24-25. One effective means of curbing this is through periodic reinspection of electrical systems to assure proper grounding, proper fuse protection and safe conductor insulation.

Charles L. Smith, electrical field engineer, NFPA, Chicago, urged the 120 registrants to develop reinspection programs *now*. To overcome lack of funds, Smith called for:

1. Proper permit fees to rehabilitate electrical systems.
2. Proper division of commercial license fees in cities.
3. Proper fees for industrial reinspection.
4. Allocation of all fees collected in connection with electrical safety, to electrical inspection departments.
5. Raising inspectors salaries to a level commensurate with their responsibilities.

If properly administered, Mr. Smith believes a reinspection program would be self-supporting. He suggested that fire prevention personnel and other local government bureaus refer all reports of electric wiring hazards to the electrical inspection bureau. Encourage the public to seek electrical reinspection through newspaper advertising, civic club and high school meetings, Smith urged. Floor discussion on the possibility of seeking local sales control ordinances revealed that Illinois laws do not permit this.

Electrical safety was the theme of many technical discussions on the two-day agenda. J. H. Witte, superintendent, combustion equipment, Underwriters Laboratories, Inc., Chicago, presented a black board talk on electrical safety control for residential and industrial oil and gas burners; revealed that, effective Feb. 1, 1949, all "labeled" oil and gas burners must have motor overcurrent protection included.

Reuben A. Erickson, president, Erickson Electric Equipment Co., Chicago, traced the evolution of switchboards and panel boards in the last



*Newly elected officers of the Cook County Electrical Contractors Association, Chicago are: (L to R) vice-president—Leo Witz, Continental Electrical Construction Co.; secretary—Victor Jensen, Jensen Electrical Co.; treasurer—Erwin Kaufmann, Kaufmann Electric Co.; president—George W. Reinke, George W. Reinke Electric Company.*



*Official family of the Electric Motor & Service Association (Central District Chapter, NISA), Chicago, include: (L to R) treasurer—A. J. Jefferies, Bowers and Clark; secretary—H. W. Reeve, Inland Industrial Electric Service Co.; retiring president—P. J. Maher, Excel Electric Service Co.; new president—P. M. Sievert, Sievert Electric Co.; vice-president—J. C. Lesseel, Central Motor & Repair Company.*

## Tickets for Lighting Show

*ADMISSION to the 3rd International Lighting Exposition at the Stevens Hotel, Chicago March 29 through April 1 is by ticket only. For yours, send in the following coupon and your tickets will be forwarded promptly. There is no charge.*

The Editor  
Electrical Construction and Maintenance  
330 W. 42nd Street  
New York 18, N. Y.

I want.....tickets for the 3rd International Lighting Exposition to be held in Chicago March 29 to April 1.

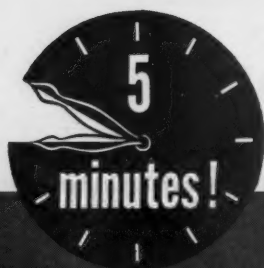
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Company .....

Address .....

City & State .....

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## FRANKEL INSULATED GUTTERTAP

...faster  
to install!

Because insulated cover clamps on in a second without screws . . . bothersome, costly taping is eliminated. Fastenings of connector and cover are accessible . . . always on the side facing the electrician.

...easier  
to install!

Because it's so compact! . . . small enough to solve the tough installation problem of tight working space. It's easier, too, because tap can be taken either from right or left of main cable.

costs less!

On larger sizes, gutterlaps show a saving of up to 33 1/3% over split-bolt connectors.

- Available in full range of sizes to fit any combination of wires from 1000 MCM through No. 14.
- All underwriter approved, of course!
- Engineered for quality and dependability — priced for economy.

Write today for your copy of catalog 4C



It's easier and faster when you use Frankel Solderless Connectors

Sold Through Leading Wholesalers Exclusively



**FRANKEL CONNECTOR CO.**

27 Vestry St., New York 13, N. Y.

42 YEARS OF KNOW-HOW IN SOLDERLESS CONNECTORS



*New chairman of the Illinois Chapter, I.A.E.I., Anton Pertle, Chicago electrical inspector, receives congratulations and gavel from retiring chairman F. K. Hanlin (Underwriters Laboratories) at recent annual meeting in Chicago.*

40 years; started a lively floor discussion on short circuit current ratings.

The flexibility and safety features of the low-voltage (24-volt) remote control system (class 2 signal circuit) for residential wiring were outlined in a lecture-demonstration by H. H. Watson, commercial engineer, construction materials department, General Electric Company, Bridgeport, Conn.

The history and development of fuse protection was presented in an illustrated talk by Paul E. Heffelfinger of Wauwatosa, Wis., special representative of the Chase-Shawmut Company. Mr. Heffelfinger clinched his talk with an effective demonstration of the construction, operation and protective features of the Trion fuse.

With the aid of charts, a sound-slide film and equipment samples, M. F. Coyle and E. Pote, service department, Commonwealth Edison Company, Chicago, gave the inspectors an insight into the tremendous field for industrial electronic applications.

At present, a substantial supply of ordinary building wire is in manufacturers and wholesalers stocks, according to A. J. McGivern, manager, Chicago Electrical Wholesalers Association. Look for a tight conduit, copper and sheet steel product situation in the spring, he cautioned.

O. K. Coleman, engineering consultant, Lafayette, Ind., led a code discussion with emphasis on grounding techniques. Tie all grounds together was Coleman's advice.

We don't believe what we know, L. Allan Sharp, commercial engineer, National Electrical Products Co., Pittsburgh, told the group in an inspirational address. We in the electrical industry face a tremendous challenge but lack the teamwork to accomplish



# Now get new customers—new sales—new profits with G-E SLIMLINE LAMPS

office... the world's most... lighting—slimline fluorescent!

Here's the greatest advance in General Electric introduced lighting since the fluorescent lamp!

**G-E SLIMLINE—NOW AVAILABLE IN QUANTITY**

Here's the great lighting since G first gave you SLIMLINE

Now available in...

NEW STREAMLINED APPEARANCE—INSTANT START—NO STARTERS NEEDED—HIGHER EFFICIENCY—LOWER MAINTENANCE COSTS—CHOICE OF THREE BRIGHTNESS LEVELS—Simplified Wiring—Cooler—Long Life

General Electric's development of slimline fluorescent lamps is the most far-reaching advance in lighting since G-E introduced the first practical fluorescent lamps back in 1938.

It's a slimline lamp gives you light in long, slender form—up to eight feet in length. They make possible higher levels of illumination, plus savings with higher efficiency, no starters, instant start, and electric, quieter, smoother, lasting effect, and many other things of interest. They are available in many other places of business. They are available in many other places of business.

If you're planning to modernize your lighting, be sure to consider your G-E Lamp supply. It will save you money from waste—both in the amount of light and in the cost of the lamp itself. It will save you money from waste—both in the amount of light and in the cost of the lamp itself.

Wherever lamps are used, it pays to look for the General Electric advantage. Because G-E Lamp research and development is under General Electric, it's the best. General Electric, Lamp's New Brighter Lamp, General Electric, Lamp's New Brighter Lamp, General Electric, Lamp's New Brighter Lamp.

You can find your confidence in—  
**GENERAL ELECTRIC**

**G-E SLIMLINE ADS APPEAR IN:** Post, Time, Newsweek, Business Week, Today's Business, Buildings, Illuminating Engineering, Institutions and Nation's Schools.

**Big, special advertising program** tells everyone that G-E slimline fluorescent lamps are on the way in quantity! Now's the time to get ready to cash in on General Electric's development of the slimline lamp, world's most advanced source of light! The market for new slimline lighting is tremendous. And General Electric is going after it with a big, special, coast-to-coast advertising campaign.

We're pre-selling your prospects with advertisements in Post, Time, Newsweek and Business Week. *Plus* hard-hitting ads aimed straight at the store, office building, institution and school fields.

*Now*—with this great new market opening up—is the ideal time to call on your "new lighting" prospects with the slimline sales story. For help and information, call your nearby General Electric Lamp office today!

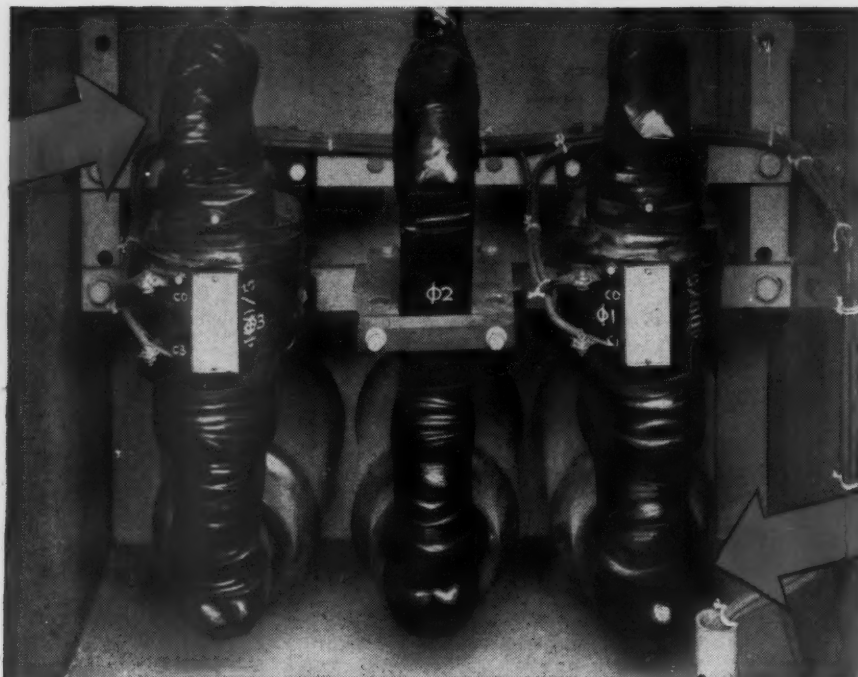
**YOU'VE GOT THE  
GREATEST SALES STORY  
IN LIGHTING HISTORY!**

**SLIMLINE  
FLUORESCENT  
LAMPS**

- ★ Modern, streamlined appearance
- ★ Instant start—no starters needed
- ★ High efficiency
- ★ Three brightness levels
- ★ Simplified installation
- ★ Easier, lower cost maintenance
- ★ Long life
- ★ High quality—backed by G-E lamp research

**G-E LAMPS**  
**GENERAL  ELECTRIC**





Rear of switchgear cubicle showing 2,300 volt line-connectors insulated in 5,000 volt classification with "Scotch" Electrical Tape No. 22—anticipating a future increase to over 4,000 volts.

## Two "Powerhouse" Tapes For Powerhouse Installations

### QUICK FACTS

about "SCOTCH" Electrical Tapes  
No. 33 and No. 22

- Tough, impervious plastic backing.
- Stretchy, to conform to odd shapes.
- High Dielectric Strength.
- Thin Caliper (.007"), takes up minimum room in junction boxes, etc.

No. 33—For jobs where extra width is not a factor. Available in standard  $\frac{3}{4}$  inch width.

No. 22—For heavy installations needing maximum coverage. Available in up to 4 inch widths.

"SCOTCH" Electrical Tapes No. 33 and No. 22—Plastic Backed—are tough, stretchy, impervious, and remarkable for *high dielectric strength, with thin caliper*. In a relatively short time they have stepped into the key spot for heavy insulation work on powerhouse equipment.

No. 22 is intended for very heavy installations and maximum coverage on bus bars, etc. No. 33 is used wherever the extra width of No. 22 is not a factor. "SCOTCH" Electrical Tapes with plastic backing are easier to apply than other insulating material, and the completed job is highly efficient, ship-shape and mighty good looking.

If you are not familiar with these remarkable new "SCOTCH" Electrical Tapes, a letter to us requesting complete information and samples will have our best attention.



ANOTHER 3M PRODUCT



MADE IN U. S. A. BY

**MINNESOTA MINING & MFG. CO. SAINT PAUL 6, MINN.**

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*Phenomenal growth is the destiny of the electrical industry reflect (L to R) E. M. Nelson, I. A. Bennett Co., Chicago; O. K. Coleman, consulting engineer, Lafayette, Ind.; and L. Allan Sharp, commercial engineer, National Electrical Products Co., Pittsburgh, at recent annual meeting of the Illinois Chapter, I.A.E.I. at Chicago.*

what we should, he intimated. The industry is not doing the selling job it could, he added, taking the contractor and inspector to task for not selling more outlets. Sell electrical benefits first. Then educate instead of legislate safety, he urged.

At the business session, Anton Pertle, Chicago inspector, was elected chairman of the Illinois Chapter. W. M. Schoknicht, electrical inspector, Central Electric and Gas Co., Rockford, Ill., is first vice-chairman; Norman H. Davis, Jr., Underwriters Laboratories, Inc., Chicago, second vice-chairman. Third vice-chairman is Carl E. Evans, field engineer, Grain Dealers National Mutual Fire Insurance Co., Danville, Illinois. W. J. Alcock, Underwriters Laboratories, Chicago, is secretary-treasurer.

C. A. Wingfield, Commonwealth Edison Company, Chicago, is chairman of the Executive Committee, Chicago industry representatives on this committee are: Contractors—George W. Reinke; Manufacturers—Robert C. Bennett, Jr., I. A. Bennett Co.; Wholesalers—Ray A. Stewart, General Electric Supply Corp.

### Twin-City Contractors Elect 1949 Officers

Newly elected officers and directors of the twin-city electrical contractor groups were installed at the annual banquet of the Minneapolis Electrical Contractors Association and the St. Paul Electrical Contractors Association, held January 12 at the Normandy Hotel in Minneapolis. The following comprise the official family of each organization:

*How you can use the*

# **FLEUR-O-LIER INDEX SYSTEM\***

Whether you make, sell, specify or buy fluorescent lighting equipment, The Fleur-O-Lier Index System will make your job easier. For the Index System provides a simple, usable method for rating and classifying fluorescent fixtures on the basis of their illuminating performance.

## **How the specifier benefits...**

The Fleur-O-Lier Index System supplies a concise, exact formula for expressing desired illuminating characteristics. The specifier can dictate desired light distribution, degrees of shielding, brightness and method of mounting. His specification is

simple and precise. It's easy to write—and easy for the purchaser to follow.

## **How the buyer benefits...**

Fleur-O-Lier fixtures are carefully examined by Electrical Testing Laboratories, Inc., and assigned a rating under the Index System. All the buyer need do is select fixtures that meet the specifier's Index System number. Then with the photometric test data and the coefficients of utilization provided with all Fleur-O-Lier fixtures, he has complete information to make an intelligent purchase of fixtures that meet the specifications and perform efficiently.

*\*To get complete information on this easy way to specify and buy fixtures, write for free booklet, "The Fleur-O-Lier Index System".*



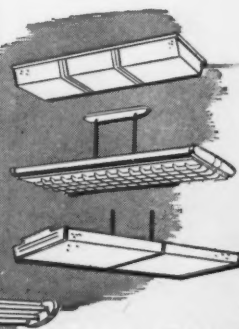
This label is attached to every FLEUR-O-LIER luminaire. It certifies that a similar fixture has been examined by Electrical Testing Laboratories, Inc., and found to conform to specifications. This label is your assurance of excellence in mechanical and electrical construction and in performance. It means that Certified Ballasts and Starters are used and that the requirements of the National Electrical Code have been met.

## **FLEUR-O-LIER**

*Manufacturers*

**2116 Keith Building • Cleveland 15, Ohio**

Fleur-O-Lier is not the name of an individual manufacturer, but of a group of fixtures made by leading manufacturers. Participation in the Fleur-O-Lier program is open to any manufacturer who complies with Fleur-O-Lier requirements.



## FOR EVERY JOB

For Safe  
Dependable Operation  
Use

# BRONCO<sup>60</sup>

**CORDS and CABLES**  
With the Dupont Neoprene Jacket

**FLEXIBLE**

For high speed production . . . on construction jobs . . . in industrial plants wherever electrical cords and cables are needed for portable tools and power equipment, BRONCO 60 can be depended upon for long, safer, dependable operation.

**TOUGH**

Flexible so that it lays flat and does not kink or tangle. Wear resistant because its Dupont Neoprene Jacket makes it resistant to heat, oil, grease, chemicals and abrasions. It stands up month after month under the toughest conditions. Electrical cord and cable failures mean costly work shutdowns . . . eliminate them by using BRONCO 60 on every job.

**DURABLE**



**See Your Wholesaler today  
and see why BRONCO 60  
is the better wire to buy.**

# WESTERN

## INSULATED WIRE CO.

1001 EAST 62nd STREET • LOS ANGELES 1, CALIF.



*The Peninsula Electrical League covers the Delaware-Maryland-Virginia peninsula, commonly known as the "Eastern Shore", and is ably represented by J. Russell Hopkins, secretary (left), and Ken J. Miller, president. Hopkins is lighting consultant with Art Craft Electric Supply Co., electrical wholesalers, and Miller is president of Miller Electric Company, electrical contractors, both located in Salisbury, Maryland.*

*Minneapolis ECA — President — Louis E. LaMay, Electric Maintenance Corp.; vice-president—Robert Donald Anderson, Parsons Electric Co.; secretary—O. H. Batzli, Batzli Electric Co.; treasurer—A. W. Strohmeier, Pierson Wilcox Electric Company. Members of the Board of Directors are: Fred Garling, John Kvalsten, W. F. Poole, D. M. Wallin, C. S. Williams and Otto Williams. A. S. Ingebredsten, L. E. LeMay and John Morris were elected as Directors to the Midwest Electrical Council.*

*St. Paul ECA—President—Felix Johnson, Pioneer Electric Co.; vice-president—Ed. Hoffmann, Hoffmann Lighting and Electric Construction Co.; secretary-treasurer—William A. Muska, Tony Muska Electric Company. Elected to the Board of Directors were: William Collins, Jr.; Don Kehne, John Kostka, Paul Schorr, Ralph Stapp, and Arthur W. Swanson. Representing the St. Paul group as Directors to the Midwest Electrical Council are Felix Johnson, Lawrence Rylander and August E. Hansen.*

## NISA Elects Regional Directors

Recently completed balloting for election of Regional Directors of the National Industrial Service Association showed the following results in areas where terms had expired: Re-elected—Fred S. Ferris, Northeastern Electric Co., Boston, Mass. (Region 1); Robert E. Ward, Electric Motor



# CUTLER-HAMMER

## SMALL DRUM CONTROLLERS

*for every purpose*

● Here are small drum controllers of every size and for every purpose . . . reversing and non-reversing . . . single and multi-speed . . . for single phase, separate winding, reconnected winding and other squirrel cage motors . . . with radial or tear drop handle, rope, or shipper rod lever actuation . . . surface, cavity or switch-board mounting.

But over and above these features are the concern for correct design, the integrity of engineering purpose and excellence in manufacture that have made Cutler-Hammer products the standard of performance everywhere. Insist on the genuine; it costs no more. CUTLER-HAMMER, Inc., 1306 St. Paul Ave., Milwaukee 1, Wisconsin. Associate: Canadian Cutler-Hammer, Ltd., Toronto, Ont.

### Where These Controllers Can Be Used . . . On

Woodworking machines

Small overhead hoists

Machine tools

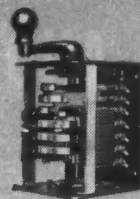
Conveyors

Tire building machinery

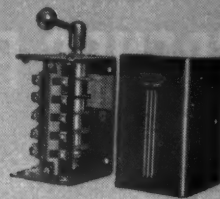
Commercial laundry equipment

Electrically operated doors

Other small motor driven processing equipment



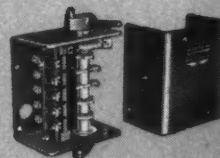
Primary resistor type reversing drum for use on small cranes



Surface mounted Size 1 reversing drum



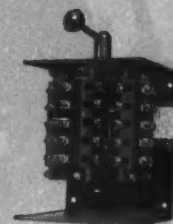
Two handle drum for 4 speed, full reversing motor



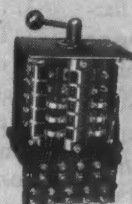
Lathe master switch, shipper rod operated



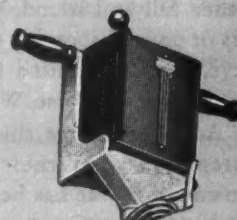
Self centering Size 0 reversing drum with tear drop handle



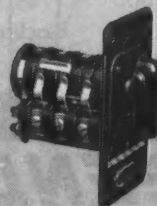
Four-speed non-reversing Size 1 drum



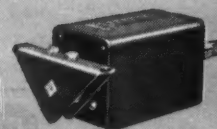
Star delta skeleton type drum for machine cavity mounting



Special multi-speed drum for floor scrubber

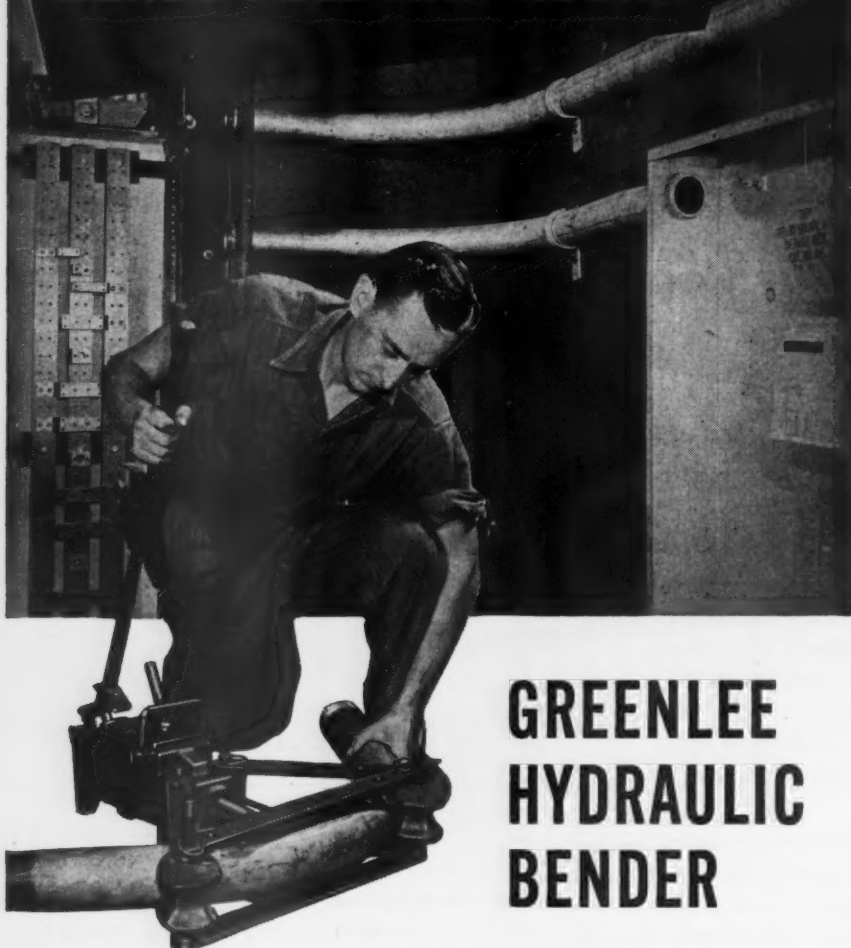


Cavity mounted selector switch—Size 00



Rope operated reversing drum for use on small hoists

# "BENDS FULL AND ROUND"



## GREENLEE HYDRAULIC BENDER

Yes, on your conduit installations you, too, will find that the GREENLEE "bends full and round, with no flatness or uneven spots on the elbow or curve," just as reported by Papentuss Electric Co., LaCrosse, Wisconsin.

"And," continues this company's statement about their GREENLEE shown above, "It has been in service nearly 11 years. On the very first job it repaid its cost and has since paid for itself many times over! Its adaptability to the different conduit sizes makes bending a simple operation and brings about substantial labor and money savings."

Investigate the GREENLEE today. See how you, too, can make big savings . . . do the job faster, better.

The GREENLEE Hydraulic Bender is one-man-operated. Makes precise, neat bends in just a few minutes—in pipe up to 4½", rigid and *thin-wall* conduit, tubing, bus-bars. It's compact, portable, easy to set up and operate.

Get all the facts on this timesaving equipment, write for your copy of new tree Bender Booklet E-201. Greenlee Tool Co., Division of Greenlee Bros. & Co., 1743 Columbia Avenue, Rockford, Illinois.



**OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK**  
Hand Benders • Joist Borers • Cable Pullers • Radio Chassis Punches • Pipe Pushers



**Merle R. Spring handles the electrical estimating chores for Spring Electric Co., Canton, Ohio; likes the diversity of his dad's contracting business which includes industrial, commercial and residential work.**

& Repair Co., Raleigh, N. C. (Region 4); Selden F. High, Sullivan Electric Co., Cincinnati, Ohio (Region 7). New directors are F. M. Mielke, Mielke Electric Works, Inc., Duluth, Minn. (Region 10); and G. E. Jones, G. E. Jones Electric Co., Amarillo, Texas (Region 13).

### Conradi Heads NISA Cincinnati Group

Edgar B. Conradi, Barkley Electric Co., Inc., Cincinnati, was recently elected president of the Cincinnati Chapter of the National Industrial Service Association. Other officers (all of Cincinnati) serving with Mr. Conradi are: Vice-president—B. G. Hendrixson, Glow Electric Co.; secretary—Selden F. High, Sullivan Electric Co.; treasurer—J. B. Matlock, Matlock Electric Company.

### EAD Now Has Managing Director

Herbert E. Cook assumed his new position as managing director of the Electric Association of Detroit on January 1st. His appointment by the Board of Governors is the first in a series of organization changes blueprinted by the Association's Planning Committee. Ultimate goal is to expand the activities and facilities of the group. Another change now in effect is the establishment of Association headquarters in Room 2514 in the Guardian Building, Detroit.

Following his graduation from



## HOW TO HOLD WIRING COSTS DOWN ...KEEP QUALITY UP!

Now, when every second counts—now, when every construction dollar must produce full value—methods of cutting costs without sacrificing quality take on new importance. That's why General Electric PVX® nonmetallic sheathed cable has become such a favorite.

PVX goes in fast—goes in to last. The tough, smooth, moisture- and flame-retardant braid covering makes for easy pulling. Its light weight makes PVX easy to handle. Its small over-all diameter permits installation in tight spots. And PVX strips freely, quickly, leaving a clean conductor for fast connection.

To get the rest of the money-saving facts on PVX and many other items in the General Electric wire and cable line, send for a free copy of the 42-page book *Building Wires, Cables, and Cords for every purpose*. Address Section W23-318, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.



**GENERAL**  **ELECTRIC**

AROUND THE CIRCUIT  
WITH YOUR  
**G-E**  
CONSTRUCTION MATERIALS  
DISTRIBUTOR



**TOUGH, FLAMENOL®** portable cords are available in types suitable for almost any portable tool. These G-E cords are built to take abuse—are just the kind of tough, durable cords that hard-working tools need. Make sure that Flamenol cords are on the equipment you buy—make them the rule when you replace cords.

**SUPER PVX** nonmetallic sheathed cable is made to order for wiring those difficult jobs where easy installation and long service life under the worst conditions are important. Its tough, thermoplastic sheath and rotproof thermoplastic insulation make it a natural for fighting corrosive fumes and moisture in barns and other tough-on-wire locations. Ask your General Electric distributor about Super PVX.



**TODAY'S** biggest wiring news is General Electric remote control. This revolutionary, new lighting control method utilizes a lightweight, two- or three-conductor No. 18 Awg

Flamenol control wire, easy to handle and low in cost. Your General Electric distributor has up-to-the-minute facts on this exciting new system. Stop by and see him soon.

**FOR INFORMATION** on any part of General Electric's line of wires and cables, contact your General Electric Construction Materials distributor. He is ready, willing, and able to help straighten out your supply problems, or give you how-to-do-it wiring information.





Here's another  
**BONUS**  
for you, partner . . .



.....Guth "One-Man" Hangers save plenty  
of costly hours of installation time!

Notice how the stems just hook onto the cross-bar, simply but securely. A little thing, perhaps, but it makes fixture-hanging an easy one-man job—and you know what savings that means!

This is a typical example of the many smartly-engineered features—big and little—which all help make GUTH precision-planned Lighting Equipment so profitable for you. And some great new developments are on the way—watch for them!

P. S. Do you have a copy of our brand new Handy Condensed Pocket Catalog 46A-A? It's yours with the compliments of



**YOUR TEAMMATE IN** *precision-planned* **LIGHTING**

**Guth**

**LIGHTING**

**THE EDWIN F. GUTH COMPANY / ST. LOUIS 3, MISSOURI**

*Leaders in Lighting Since 1902*



*Post meeting confab on low voltage remote control wiring occupies (L to R) R. C. Dean, district manager, North Central Div., G.E., Chicago; H. H. Watson, commercial engineer, construction materials dept., G.E., Bridgeport; D. J. Talbot, chief electrical inspector, Chicago; and B. H. Etsinger, engineer, G.E. construction materials dept., Chicago.*

Kearny High School in New Jersey, Mr. Cook served for 18 months with the Royal Flying Corps of Canada and the U. S. Navy, then entered Princeton University in the Class of 1923. After college "Herb", as he is known to his business associates, joined the General Electric Co., first at Harrison, N. J., and then at San Francisco, California.

In 1925, he joined the Lighting Sales Division of the Detroit Edison Company; switched to the Customer Service Division in 1928. An early member of the old Detroit Electric Club, Mr. Cook continued his activities in the present association. He was coordinator of the committee for all-electric home promotion; first a utility representative, then director and later chairman of the Adequate Wiring Committee.



*Overload protection techniques get a thorough airing at Chicago conference of Illinois Chapter IAEI by (L to R) electrical contractor Frank Mishler, Woodstock, Illinois; Alfred S. Leon, electrical inspection department of Boston, Mass.; and C. E. Grover, Bussmann Mfg. Co., sales engineer, Chicago.*

## Proposed Labor Legislation

It is almost certain that any new labor law which Congress substitutes for the Taft-Hartley law will restore the right of employers and unions to sign closed shop contracts.

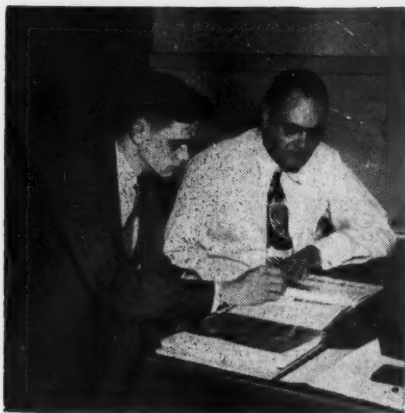
There will also be some curb on jurisdictional disputes and secondary boycotts invoked in aid of a jurisdictional dispute.

These are the two points of major interest to electrical contractors in the consideration of new labor legislation now before the 81st Congress.

Identical bills containing the proposals of President Truman were introduced in the Senate and House by the chairmen of the labor committees. The Truman bill would repeal the Taft-Hartley law and restore the Wagner Act with some "improvements." These include (1) making unfair labor practices of jurisdictional disputes and secondary boycotts in connection with them, (2) requiring a 30-day notice to the government of any proposed contract changes or terminations, and (3) establishing a 30-day cooling-off period for national emergency disputes.

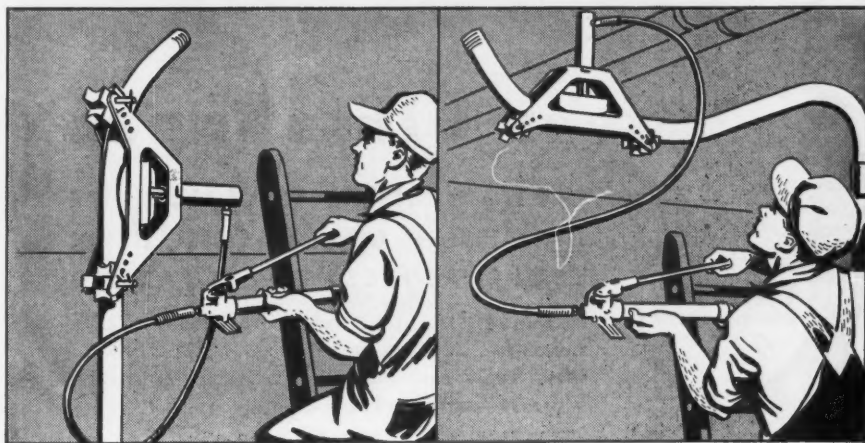
Jurisdictional disputes would be decided by the National Labor Relations Board or an arbitrator appointed by it. It would also be an unfair labor practice for an employer to refuse to assign work in accordance with a decision of the Board or the arbitrator.

There is no restraint in the bill against jurisdictional strikes or boycotts while a decision is being considered. This provision may be stiffened to permit NLRB to make a "summary finding," pending a final decision, which would be enforceable in the courts. In that event a stoppage could become contempt of court. There



Father and son combination operate the Consolidated Electric Co., St. Paul, Minn., electrical repair and construction firm. Here engineer John A. Gardeen (left) checks equipment specifications with his dad Carl J. Gardeen, president of the company.

## You Get 4 Exclusive Advantages with a Blackhawk Pipe Bender



### 1. WORKS IN ANY POSITION

A Blackhawk Porto-Power Pipe Bender is completely versatile. It works in any position — vertical — horizontal — or at any angle. The remote control Porto-Power pump makes this extra utility possible.

### 3. TAKE IT RIGHT TO THE JOB

A Blackhawk pipe bender's light weight and all-directional operation lets you bend pipe right at the installation instead of lugging pipe to the bender. Saves time — work — steps — makes it easier to fit bends to obstructions.



### 2. DO OTHER WORK

The Blackhawk Porto-Power hydraulic unit detaches to work with numerous other Porto-Power attachments to handle dozens of lifting, pulling, pushing, clamping, pressing, bending and spreading operations.

### 4. ELECTRIC OPERATION IF DESIRED

P-182 electric pump permits fingertip control pipe bending — speeds work — leaves hands free for measuring. Ideal for continuous bending of elbows, etc. P-182 also can convert any other hydraulic equipment to power operation.



530A Pipe Bender with 10-ton hydraulic unit handles rigid conduit and pipe in 1, 1 1/4, 1 1/2 and 2" diameters.



536 Pipe Bender with 20-ton hydraulic unit handles rigid conduit and pipe from 1 1/4 to 4" in diameter.

Your Blackhawk Industrial Supply Distributor will give you full information on cost-cutting Blackhawk Porto-Power Pipe Benders.

A Product of BLACKHAWK MFG. CO., Dept. P-2039, Milwaukee 1, Wis.

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protect against EXCESSIVE MOISTURE  
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Save up to 75% of materials cost on rewind jobs . . . make  
motors last six times longer between rewinds. Imcor  
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*Edward Gudum, vice-president of Harlan Electric Co., Detroit, is a keen student of modern installation techniques; supervises the engineering, estimating and construction activities of the firm.*

are reports that the building trades unions would like some such "club behind the door".

What the affect of new legislation will be on the year-old National Joint Board for Settlement of Jurisdictional Disputes is difficult to foresee before the actual provisions of the new law are known. For the time being, the AFL building trades department and the contractors have decided to continue the board with some procedural changes now under consideration.

Even in restoring the closed shop, this Congress may not go all the way back to the Wagner Act freedom. There is considerable sentiment among the legislators for eliminating some of the abuses of the closed shop, such as restrictions on union membership and arbitrary expulsions for what some persons may consider unjustifiable reasons.

Testimony favoring removal of the T-H closed shop ban and endorsing the Truman bill was given the Senate Labor Committee by Paul M. Geary, executive vice president of the National Electrical Contractors Association, and Richard J. Gray, president of the AFL building trades.

Geary made these major points:

—The electrical contracting industry has gotten along well with the IBEW. Where the machinery of the Council on Industrial Relations, organized 29 years ago, has been invoked there has not been a strike.

—Legislation outlawing the closed shop impairs the employer's right of contract.

—Employment in the industry is intermittent. The contractor must have access to some dependable source of labor supply where he can, on short



*Reflects the  
Craftsman's Skill*



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OTHER PATENTS PENDING

## THE MAGNO-TRONIC FLUORESCENT STARTER

PROTECTS  
SIMPLIFIES  
REDUCES COSTS

VERSATILE

Fully, automatic thermal relay with unusually long life that eliminates blinking lights and protects all auxiliary equipment. Replacement of worn-out lamp automatically restores closed circuit—replacement of starter unnecessary. No button to push. Magno-Tronic starters provide exact timing in the lamp electrode—preheating process preventing excessive loss of emission material, thereby assuring the maximum in the useful life of a lamp. The established quality of this starter saves considerable time in maintenance and man hours required to repair and/or replace an inoperative lighting unit. Will operate efficiently over an extended voltage range under widely varying temperatures.

GUARANTEED FOR ONE YEAR.

The (SP-15-20) for use with either 15 or 20 watt lamps  
The (SP-30-40) for use with either 30 or 40 watt lamps  
The (SP 100) for use with 100 watt lamps

Ask for descriptive literature

## INDUSTRIAL ELECTRONICS CORP.

MAIN PLANT



Newark 2, N. J.



notice, draw as many skilled mechanics as a job may require, with the understanding that they may be laid off without notice.

—Application of the Taft-Hartley closed shop ban may destroy the industry's Apprenticeship and Training System under which 20,000 young men are in training in 400 areas. Inexperienced workers would try to forego apprenticeship and obtain jobs as skilled mechanics. Knowledge of the skill of the men he will hire is necessary to a contractor in estimating a job.

## Survey on Safety

Electrical construction contractors will get an idea of how hazardous occupations in this industry are in comparison with others from a detailed survey of injuries in the construction industry being conducted by the Bureau of Labor Statistics.

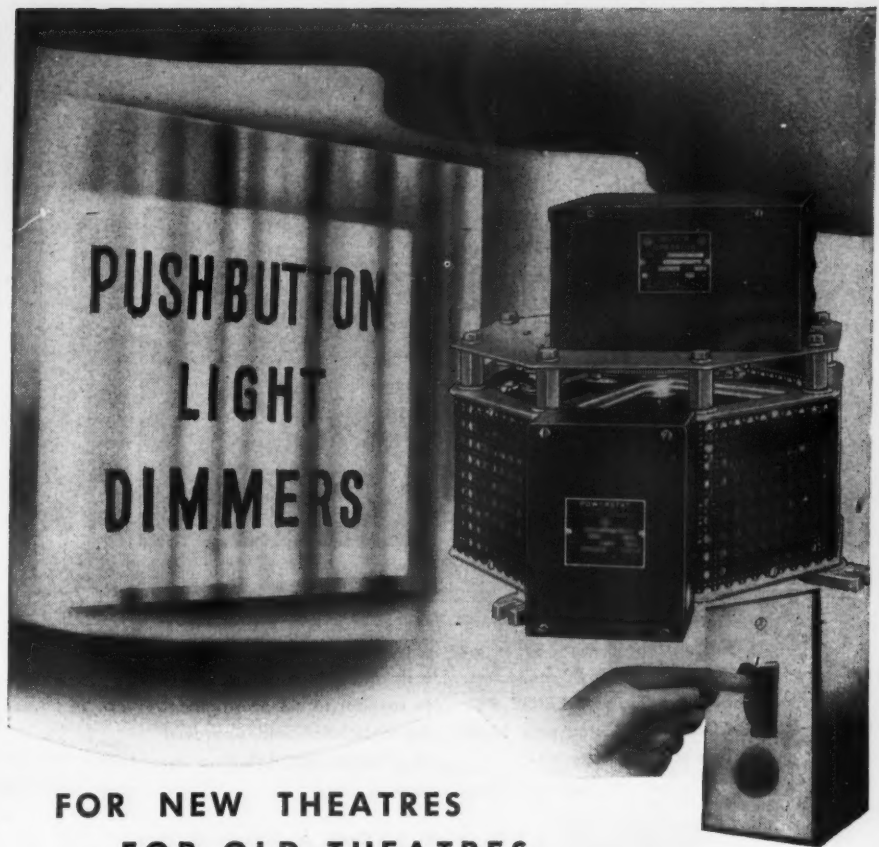
Once the most hazardous occupations are determined, BLS will try to find out how the injuries occur and suggest ways of avoiding them.

Some 53,000 questionnaires have just been distributed by BLS to general contractors as well as those in the specialty groups, including electrical.

This detailed survey, covering 1948, is one of several conducted every year by BLS in particular industries. It will take the place this year of a more general study made in all industries. George R. McCormack, of BLS, in charge of special injury studies, is handling it.



Education minded M. F. Coyle (left) supervisor, and E. Pote, training supervisor, service department, Commonwealth Edison Co., Chicago, gave Illinois electrical inspectors an insight into industrial electronics applications at recent Chicago conference.



## FOR NEW THEATRES FOR OLD THEATRES

Push the button at your fingertips — and the POWERSTAT Dimmer lowers or raises houselights smoothly, silently and efficiently. Dimming, brightening or blending house or stage lights to create desired audience moods is easy with this modern light dimming equipment. From any one or a number of remotely-located stations throughout your theatre, you have instant, effortless control of the intensity of your lighting. The manager, at a convenient location; the head usher, from his station; or the projectionist, from his booth, can dim the house and proscenium lights by pushbutton action. There is none of the shock attending the usual "ON-OFF" switching. Quietly, unobtrusively, houselights lower to signal the start of the screen performance. Just as effectively, after the picture, houselights brighten to enable patrons to leave the theatre quickly, safely and comfortably.

Building a new theatre? Renovating your present operation? There's a POWERSTAT Dimmer to meet every application. These modern light dimmers handle incandescent and cold-cathode installations with equal effectiveness — provide trouble-free service.

*We'll be glad to send you complete information on how POWERSTATS can be used in your plans for theatre lighting — write us today.*

**WRITE 6039 DEMERS AVENUE, BRISTOL, CONNECTICUT**

**THE SUPERIOR ELECTRIC CO.**  
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POWERSTAT VARIABLE TRANSFORMERS • VOLTBOX A-C POWER SUPPLY • STABLINE VOLTAGE REGULATORS

**SAVE \$7.20 ON EVERY HOUSE,  
MR. CONTRACTOR!**

with the  
**PAIGE #52  
CONNECTOR**

**For Non-Metallic  
Sheathed Cable**

- EASY TO INSTALL
- TAKES ONLY 7 SECONDS
- NO SPECIAL TOOLS NEEDED
- Holds Cable In Place Without Screws Or Lock Nuts... For Strain Relief, Too.

Figure it out for yourself, Mr. Electrical Contractor. In wiring the average 5-room house today, you will use 80 connectors. By using the new PAIGE #52 CONNECTOR, you save \$7.20 in labor and materials!



For a lot of jobs, that saving really adds up. And it's one more spot where you can cut costs and labor time, something to consider in the ever-tightening construction field. Approved by Underwriters' Laboratories.

Ask your local jobber or write

**Allied** 1 N. LaSalle St., Dept. A Chicago 2, Ill.  
**ELECTRICAL MANUFACTURING CORP.**



**J. H. Witte, superintendent, combustion equipment, Underwriters Laboratories, Inc., Chicago, explains safety control wiring for oil and gas burners to Illinois electrical inspectors at Chicago meeting.**

Information requested in the questionnaire includes:

Average number of employees and employee-hours worked.

Number of deaths, and number of cases of permanent disabilities, permanent partial disabilities and temporary total disabilities. Information is also asked as to the duration of the temporary total disabilities.

## San Francisco Assn. Elect Officers

W. B. Baker has been re-elected president of the San Francisco Electrical Contractors Association. Roy Crooks, of the Charles A. Langlais Co., is vice-president; Edward W. Scott, secretary, and E. F. Dowd, of Dowd-Seid Co., treasurer.

Directors for the year are Victor Lamoge, L. Roy Moser, H. C. Reid, W. T. Kennedy, F. W. Schultz of Atlas Electric and Engineering, P. J. Furlong of Century Electric Co., and Ken M. Ryals of Stone-Ryals Electric and Manufacturing Co.

Baker is also president of the Sheet Metal Contractors Association of San Francisco.

## Overtime on Overtime

Special protection for the construction industry against compulsory "overtime on overtime" under the wage-hour law is contained in a bill approved by the House Labor Committee.

**EASY  
3-STEP WAY**  
to hang chain-suspended fixtures with  
**HYDEE HANGER\***

1. Connect wires to receptacle. Fits standard 4" or 3 1/4" outlet box or plaster ring. Only tool needed is a screwdriver.

2. Screw hanger to outlet box—only two screws needed. No centering, no punching, no drilling.

3. Hang the fixture and just plug it in. That's all! Self-grounding—regular 2-wire cord and plug may be used.

### HYDEE HANGERS\* REDUCE INSTALLATION TIME

Complete with receptacle, two 5-foot chains, "S" hooks and clips. Nothing else to buy.

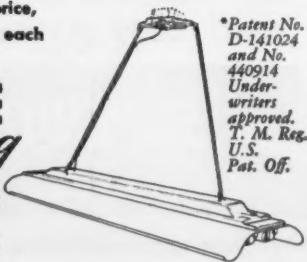
List price,  
\$1.65 each

IT'S EASY TO SEE WHEN IT'S

**DAY-BRITE**  
*Lighting*



Day-Brite Lighting, Inc., 5402 Bulwer Avenue, St. Louis 7, Missouri. Nationally distributed only through leading electrical wholesalers.  
In Canada: address all inquiries to Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.



\*Patent No. D-141024 and No. 440914 Underwriters approved, T. M. Reg. U.S. Pat. Off.

The bill, limited to the construction and longshore industries, would approve as legitimate overtime pay any time and a half wages paid under a union contract for work on holidays, week-ends, outside the regular daytime hours, after eight hours a day, etc.

This means that the extra pay, above the regular hourly rate, does not have to be included in figuring the "regular rate" on which time and a half after 40 hours a week must be paid under the wage-hour law. Also, the hours for which time and a half is paid may be credited toward any overtime pay due under the law.

The prospect is that Congress will adopt either this or some other bill which will give the same general protection against "overtime on overtime."

## Lighting Exposition Opens March 29 In Chicago

Replete with many new features not found at previous Expositions, the Third International Lighting Exposition and Conference will be ready to open its doors on March 29 for a four-day session continuing through April 1st, at the Stevens Hotel in Chicago, under the sponsorship of the Industrial and Commercial Lighting Equipment Section of the National Electrical Manufacturers Association.

For the first time at any International Lighting Exposition, the winning entries in the Merit Award Competition will be displayed in Art Gallery Style around the walls of the



Electrical inspectors Harry Madison (left), Winnetka, Ill.; and Charles P. Dahncke, Wilmette, Ill., discuss inspection problems in their respective municipalities at Illinois Chapter, I.A.E.I. meeting in Chicago.

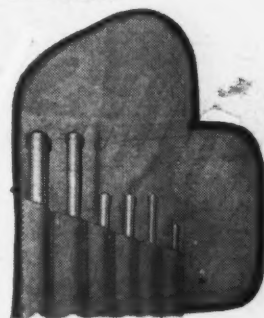


Rotary drill them closer together—without chipping—with Carboloy Masonry Drills! And get the other advantages these remarkable rotary drills offer you:

- Two styles (fluted or round) for deep or shallow holes
- Wide range of sizes
- Drill four times faster
- Carboloy Cemented Carbide tips drill any masonry
- Drills stay sharp up to 50 times longer
- Fit any standard press, rotary drill, or hand brace
- Drill clean, accurate holes quietly
- Available singly or in these handy kits of six assorted drill sizes

No wonder these rotary drills work so fast, stand up so long. The tips are made of Carboloy Cemented Carbide—the hardest metal made by man!

Send the coupon for more information about these time-and-money-saving drills, and about the three handy kit assortments.



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Gentlemen:

Please send me Folder SA 236, describing Carboloy Masonry Drills and their advantages to me.

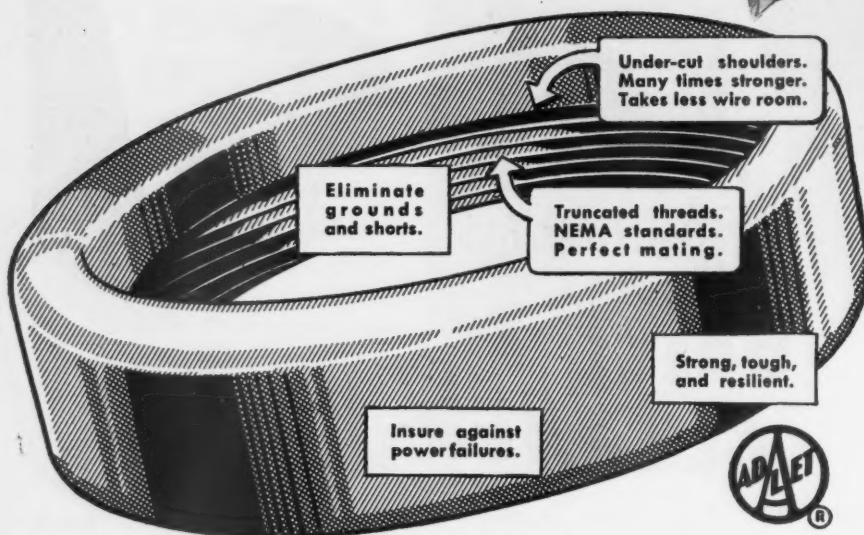
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**BROTHER, I'LL TAKE ADALET INSULATING BUSHINGS EVERY TIME-AND HERE'S WHY..**



**PROVEN!** Sali is the original Insulating Bushing, proven by many years of hard service.

**NEW!** Adalet Molded Insulating Bushings. Priced low. A great big dollar's worth.

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**FREE!** ADALET, 14300 Lorain Avenue, Cleveland 11, Ohio.



**Gordon Tucker, new manager of the Midwest Electrical Council, Inc., Minneapolis, is directing his managerial talents to expansion of the Council's service philosophy. Membership now includes contractor groups from Minnesota, North and South Dakota, with numerous individual members from surrounding states.**

Exposition Hall of the Stevens Hotel. All of the Merit Award Entries in this year's Competition are displayed on mounting boards so that visitors to the Exposition can study and examine photographs, blueprints and other details easily, at their convenience. The Gold Seal and Merit Award Winning Case Studies in this Competition, numbering over 100, represent the finest techniques and latest procedures in planned lighting as used in recent installations by leading Architects, Consulting Engineers, Utility Lighting and Power Men, Electrical Contractors and Wholesalers and Users of Industrial and Commercial Lighting. They were selected for top honors by the judges from a field of nearly 300 Lighting Case Studies submitted.

Nearly 100 Exhibitors are completing preparation of their booths which will display and demonstrate all the newest developments in industrial and commercial lighting equipment. Among these are the new luminous louvered ceiling and troffer lighting; New ideas in fluorescent lamps and the sockets and fixtures for installing them, as well as new lighting devices and equipment, in many cases never exhibited anywhere before.

The exposition hours, Tuesday March 29 through Friday, April 1st, will be from 12 Noon to 6 p.m. and in addition, for those who wish to see the exhibits at night, the exhibition hall will be open Thursday evening, March 31, from 12 Noon to 9 p.m.

The Conference Program includes as speakers, some of the top officials of organizations and companies in lighting and allied fields... such men as L. E. Taylor, President, IES;

**ADJUSTS**  
WITH A  
TWIST OF THE WRIST

**"Friction Set"**  
**Fixture Hangers**  
FOR INSTANT ALIGNMENT

At last you can get a Fixture Hanger that turns to any angle after being screwed to an outlet box. Although base and receptacle remain stationary, hanger arms may be turned to align with any preconceived lighting plan. Exclusive Friction Ring firmly holds fixture in selected position. Hanger screws on to 3/4" or 4" outlet boxes, no other fastening necessary. Furnished complete with receptacle, two S' chains, hooks and cord clips. Also available with bushed hole only, or with 3 wire solid ground receptacle. All Friction-Set Hangers are approved by the Underwriters' Laboratories. K100 shown above, List Price \$1.10 • Write for Bulletins K25, K26 and K27

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B. W. Clark, President of NEMA and Vice President of Westinghouse Electric Corporation; D. M. Salsbury, Vice President, National Electrical Wholesalers Association and President of Westinghouse Electrical Supply Company; Eric Johnston, President, Motion Picture Association of America, Inc.; Robert W. McChesney, President, National Electrical Contractors Association and of Harry Alexander, Inc. and Ward F. Davidson, Research Engineer, Consolidated Edison Company.

At the Tuesday morning session the winners in the Merit Award Competition will be announced. R. D. Bradley, Chairman of the Merit Award Competition Committee will present the Gold Seal and Merit Awards to the individuals responsible for the winning Lighting Case Study Entries.

A high spot of the Conference Sessions will be Lecture-Demonstrations; Wednesday morning, "What the Lighting of the Future Will Mean to You" conducted by Alston Rodgers, Senior Lighting Engineer, General Electric Company, Nela Park; Thursday morning, "Glass Comes of Age" by Harold G. Vogt, Corning Glass Works; and Friday morning, "Plastics, The New Look in Lighting" by F. W. Tetzlaff, Plastics Department, Rohm & Haas Company.

## Lynett Heads New York State Inspection

The New York Board of Fire Underwriters, who for the past 70 years has conducted an electrical inspection service throughout the Greater City of New York, also throughout the Coun-



Active in IAEI Chapter functions are (L to R) H. Kantorwitz, St. Louis, Mo., secretary of the St. Louis Chapter and S. R. Todd, Chicago, chairman of the meetings and program committee of the Illinois Chapter.

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★ WIRING SPECIALTIES ★

## MINIMUM OF PARTS— MAXIMUM OF SERVICE!

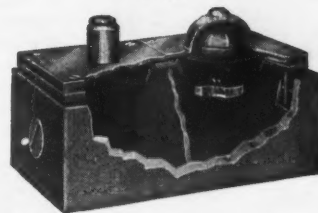
"Latrobe" Floor Boxes and Wiring Specialties are designed to do their jobs in the simplest, most straightforward manner possible.

Their neat, compact construction makes them easy to install and doubly assures smooth, dependable service over the years.



**No. 110 "Latrobe"  
Watertight Box**

A sturdy, non-adjustable Floor Box that is a dependable performer. Can be speedily installed and is watertight. Has 208 Receptacle. Cover Plate 3 1/2" diam.



**No. 252-R "Latrobe"  
Two Gang Box**

This adjustable Two Gang Floor Box has No. 208 Receptacle in one section. It is efficient and economical. One Cover Plate has 1/2" Flush Brass Plug; the other, 2" Flush Brass Plug.



**No. 150 Box  
No. 207 Nozzle**

A compactly built box for installation in concrete or wood finished concrete floors. Adjustable and watertight. 4 1/4" Cover Plate No. 242 and large Adjusting Ring No. 215.



**No. 284 Nozzle with  
No. 200 Cover Plate**

This Duplex Receptacle Nozzle is one of the many well designed Nozzles for use with "Latrobe" Watertight Floor Outlets. The No. 284 is furnished with 1/2" or 3/4" Brass Pipe Extension.



**Keystone Fish Wire**

Finest grade flat steel wire, expertly tempered. Ten sizes, for lightest work up to heaviest power wiring. 100, 150 and 200 foot coils.

Sold Only Through  
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**BX Cable Staples**

These high quality "Bull Dog" staples are favorites from coast to coast. Packed by carton, keg and barrel. 2500, 6000, and 30,000.

**FULLMAN MANUFACTURING CO.**  
**LATROBE . . . PENNSYLVANIA**



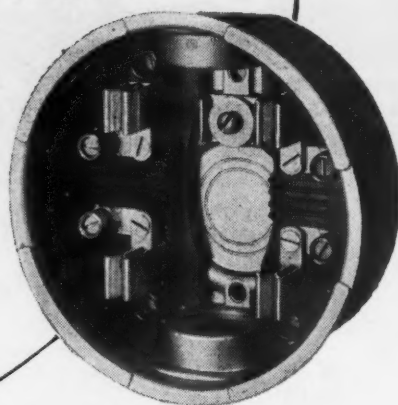


## standardized deep meter socket

**FEWER ITEMS TO STOCK!  
EASIER INSTALLATION!**

### LOW PRICE PLUS

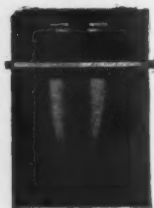
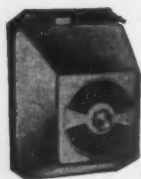
1. Additional wiring space for more liberally rated conductors
2. Increased current-carrying capacity
3. Bonded plus baked-on aluminum paint for increased corrosion resistance and longer life
4. Base is die-cast for strength and permanency of dimensions
5. One-piece snap-action stainless-steel ring. No tools required for installing this quick-hitch ring.



● This new four-terminal standardized socket, Type R-1, covers with one catalog item the widest practicable range of applications and ratings for single-phase metering. It reduces the number of items to be stocked, increases interchangeability, and provides for future growth.

Detailed specifications and installation suggestions are available from your nearest G-E representative. Consult him today, or write for Bulletin GEA-5147. Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

**GENERAL ELECTRIC**



## AUDIBLE SIGNALS

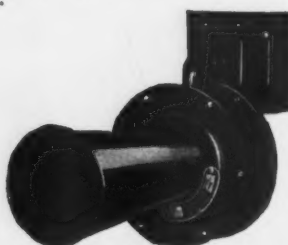
### BELLS • CHIMES • HORNS

Single stroke Bells for multiple or series circuits. Vibrating Bells for operation in multiple only. 4" to 20" sizes, indoor and outdoor.

Special tone Signals: musical and soft tone Bells, Chimes, Cow Gongs, Horns and Whistles.

Also contactless vibrating and explosion-proof Bells.

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RELAYS • SIGNALS • CODE CALL AND FIRE ALARM SYSTEMS

# SIGNAL ENGINEERING

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*Pre-session huddle on wiring codes is held by Lloyd Turnbull (left), Central Illinois Light and Power Co., Peoria; and Arthur Rieck, chief electrical inspector of Des Plaines at Illinois Electrical inspectors conference in Chicago.*

ties of Nassau, Suffolk, Westchester, Putnam and Rockland, has extended its service to cover the entire State of New York. They are assuming the electrical inspection activities throughout the upper State of New York, which have been carried on by the New York State Fire Insurance Rating Organization.

James D. Lynett, superintendent of the Bureau of Electricity throughout the State, will have general executive jurisdiction of all offices and departments and the chief inspectors will work closely under his supervision and direction.

The Bureau of Electricity of the New York Board of Fire Underwriters will continue to operate the offices heretofore maintained by the rating organization at Albany, Buffalo, Rochester and Syracuse. The business offices of the Bureau of Electricity of the Board will continue to be located with the New York State Fire Insurance Rating Organization but under the jurisdiction of the New York Board.

## Book Reviews

### Lighting Fundamentals

Combining clear discussion, lucid drawings, descriptive photographs, concise tables and the functional use of color, a new ring-bound handbook, "Fundamentals of Light and Lighting", has been published by the Engineering Division, Lamp Department of the General Electric Company. Edited by Walter Sturrock and K. A. Staley, the handbook reviews basic theories of lighting; explains fundamentals of photometry, candlepower distribution and brightness; discusses photometric laboratory and field measurements and



essential measuring equipment; defines light control in terms of reflection, transmission, refraction, diffusion, absorption and polarization; analyses the relationship between light and color; specifies quality and quantity of approved illumination, and thoroughly treats the step-by-step methods for designing typical lighting systems. Large-scale nomographs for easily obtaining essential lighting calculations are included for practical use, and a comprehensive glossary of definitions includes terms related to photometric quantities, materials and accessories, illuminating glasses, characteristics of illumination, photometric standards and tests, and illuminants. As a practical working guide in designing a lighting system, specific examples are used to show the use of charts, diagrams and work sheets which are included in the handbook. Measuring 8½-by-11-inches, the handbook is priced at \$1.00 and includes 88 pages.

## Industrial Electronics

A complete coverage of basic theory related to electron tubes, associated circuits and control component devices used in the industrial and commercial electronic operation is found in "Industrial Electronics and Control" written by Royce G. Kloeffer, Professor and Head of the Electrical Engineering Department at Kansas State College. The book, in a direct, simple, easily understood style, offers a basic introduction to the electronic field and related industrial applications; a thorough treatment of thyratrons and gaseous tubes; a presentation of basic components, and circuits or tools of



*Twin-City rivalries are forgotten at the annual joint meeting of the St. Paul and Minneapolis Electrical Contractors Associations. Presidents of the two organizations, Felix Johnson of St. Paul (left) and Louis LeMay of Minneapolis are staunch supporters of constructive competition.*

## FASTER • EASIER • LOW-COST INSTALLATIONS

NEW

1¼ inch



**THINWALL BENDER** With toe release hook which returns automatically to the starting position by simply touching the release arm with the toe after conduit is formed. The only bender which can be released from conduit with very little effort. Cat. No. 226.

## LEW Electric Fittings

• Contractors' Headquarters . . . everything for the contractor to insure good installations. Wise selection of materials is perhaps the most important step in making installations that pay. We say then, make LEW your headquarters—use LEW FITTINGS on every job and secure for yourself a good share of business in this progressive industry. We invite inquiries. Write for literature.

### Double Duty ½", ¾", and 1" E. M. T. Forming Tools

PAT. No. 2,233,292

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Only forming tool with the release hook.

No. 222 . . . . . ½" or ¾" double duty

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### SHORT RADIUS ½" THINWALL BENDER

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### SPIRAL FISH CABLE—Pat. No. 1,858,997

360° rigidity control. For use in oval conduit, Greenfield, or any metallic tubing in 25-, 50-, and 100-foot lengths.

### NOW IN STOCK



Thinwall single duty benders with automatic toe release hooks.

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221	1½"
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### FLOOR OUTLET BOXES



#### NON-ADJUSTABLE

Three ½" holes drilled and tapped in side and two ½" holes drilled and tapped in bottom.



#### ADJUSTABLE

Deep and shallow bodies. Four ½" or ¾" holes drilled and tapped in sides.

UNDERWRITERS APPROVED

### Rigid Conduit Bender with Bull Dog Grip

No. 2100 will form ¼" to ¾"

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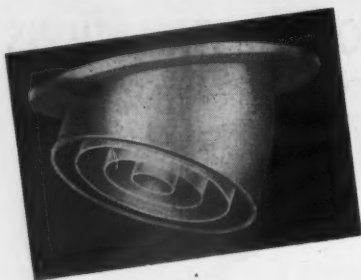


Made for the toughest kind of work. Excels all other Benders by test.

## Lew Electric Fittings Co.

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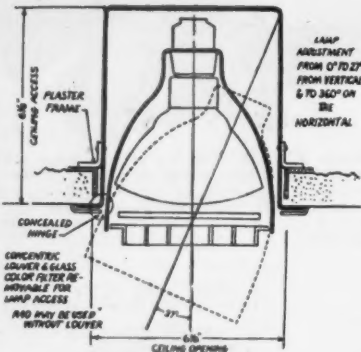
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**THE FINEST  
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Write for complete details and prices.

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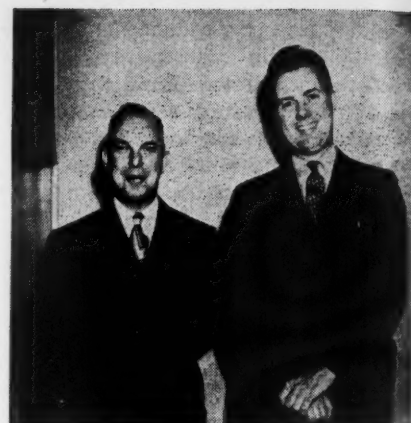
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**Top notchers of the St. Paul Electrical Contractors Association are (L to R) president Felix Johnson (Pioneer Electric Co.) and vice-president Ed. Hoffmann (Hoffmann Lighting & Electrical Construction Co.). Both look forward to a successful 1949 administration.**

control; a fully illustrated discussion on servomechanisms, and instructive diagrams conforming to ASA graphical symbols. Little is taken for granted in presenting each subject, and numerous specific applications are utilized to clarify or emphasize the text. The book is written both as a guide and reference book, including fundamentals and information pertaining to practical applications. Some indication of the book's scope can be obtained by reviewing the table of contents, which refers to electron emission, vacuum diodes, gaseous conduction, grid-controlled vacuum tubes, crystal and metallic rectifiers, control components and circuits, rectification and inversion, high-frequency heating, resistance welding, photoelectric control devices, electronic regulation, X-ray applications, special photo applications, and numerous related subjects in this rapidly-expanding field. Including 478 pages, size 6-by-9½-inches, the book is priced at \$5.50 and is published by John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y.

## Design for Welding

A significant record of the progress of arc welding in all branches of industry during these postwar years is contained in "Design for Welding"; a book combining abstracts of 82 award papers, illustrative photographs, drawings, tables and cost data. Edited by Professor R. S. Green, Acting Chairman of the Department of Welding Engineering at Ohio State University, emphasis is placed upon projects having the objective of improving efficiency and economy through the utilization of a wide variety of welding

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OUTLET BOXES, CABLE  
BOXES, EXTENSION  
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Made in standard depths and combinations for use with heavy or thin wall conduit, armored cable, non-metallic sheathed cable, flexible steel conduit or flexible non-metallic tubing (loom). Also a complete line of covers for each type and size of box.

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techniques and applications. Welding trends are indicated in numerous chapters, for discussion stresses welding in mass production where price and quality must meet competitive standards. Over 1000 pages of text material cover the fields of the airplane, automotive and railroad industries, structural endeavor and machine design. Bound in semi-flexible simulated leather covers, the book is priced at \$2.00, measures 5½-by-7½-inches, and is available from the James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio.

## Electronic Transformers

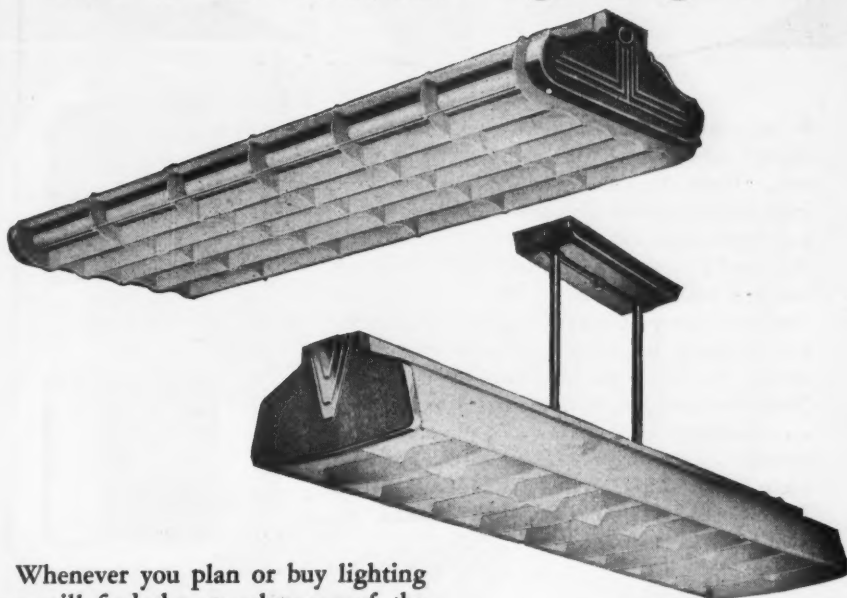
This book is unique in its field, being the only compilation of complete data pertaining to the design of "Electronic Transformers and Circuits" for electronic apparatus. It answers the long felt need of broadening the mutual understanding between designers of electronic transformers and inductors, and designers of circuits utilizing such apparatus. Written in a straightforward, logical manner, the book is clear and readily understandable for the average non-specialist in this field. Author Reuben Lee, advisory engineer, Industrial Electronics Division, Westinghouse Electric Company, deals intimately with important developments in video and pulse transformers, radar and communications, and he writes at length on various applications rather than on pure theory, since the book is primarily intended for men actually working in the field. Including 211 illustrations on the 284 pages measuring 6-by-9½-inches, the book is priced at \$4.50 and is published by John Wiley and Sons, Inc., New York City.



Lewis Molitor, electrical contractor of Sunnyfield, Ill., and Jack G. Krider, Manager, Illinois Chapter, NECA, in a lobby chat at a recent Peoria meeting of Illinois Electrical Contractors.

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Whenever you plan or buy lighting you will find the completeness of the Kayline range of fixtures can't be matched. Specifications for the entire building can be written from the Kayline catalogue and all purchases made from one source. Each lighting unit is designed for easy installation and maintenance.

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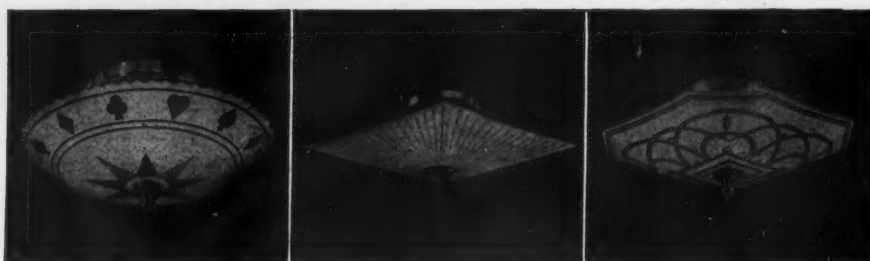


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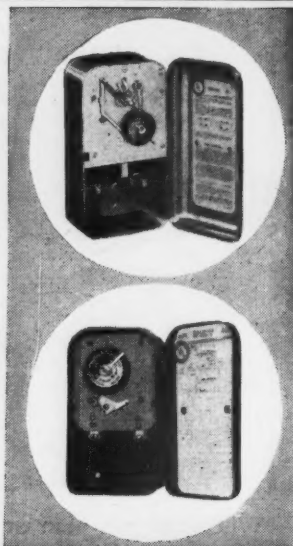
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Use fast-working electrical tools on any construction or maintenance job with this high capacity, portable, compact electric plant. Equipped with four-receptacle box for direct plug-in of tools or lights. Available with carrying frame, or dolly-mounted. Powered by Onan 10 HP, two-cylinder, 4-cycle, air-cooled engine. Shipped complete ... ready to go!

NEW ONAN "CK" ELECTRIC PLANTS are available in 5000 watts D.C., 115 and 230 volts; 2000 and 3000 watts A.C. in all standard voltages. COMPLETE ELECTRIC PLANT LINE INCLUDES: A.C.—350 to 35,000 watts in all standard voltages and frequencies. D.C.—600 to 15,000 watts, 115 and 230 volts. Battery Chargers—500 to 6,000 watts, 6, 12, 24, 32 and 115 volts. ONAN AIR-COOLED ENGINES—CK: 2-cylinder opposed, 10 HP. BH: 2-cylinder opposed, 5½ HP. 1B: 1-cylinder, 3¼ HP.



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## ONAN ELECTRIC PLANTS



Chief electrical inspector W. H. Burns (left) of the City of Peoria, Ill., discusses installation practices with electrical contractor Fred G. Volle, Volle Electric Service, Springfield, Ill.

## Engineering Information

A valuable guide to engineering literature and data, under the title, "Sources of Engineering Information", has been compiled by Blanche H. Dalton, librarian of the Engineering Library at the University of California in Berkeley. Concise and complete, this reference book enables the technical man to find the key to all research previously published in a particular field by turning directly to the topic. Priced at \$4.00, the book is published by the University of California Press.

## Electronics Reference

The application of electronics in industry, the future possibilities of electronic devices, and the "why" and "how" behind electronic principles are covered clearly and interestingly in the "Industrial Electronics Reference Book", compiled by electronics engineers of the Westinghouse Electric Corporation. The book is written for those with only a basic electrical engineering training and therefore makes liberal use of illustrations to clarify discussions on design and application, possibilities as well as limitations of devices, and fundamentals behind the constantly changing apparatus in this field. With 37 different engineers co-operating on the text, each chapter is written by an expert on the particular phase or subject being treated, and 1147 illustrations are used on the 680 double-column 9-by-12-inch pages. Listed at \$7.50, this reference source is published by John Wiley and Sons, Inc., New York City.

## Dates Ahead —

**National Electrical Manufacturers Association**—Winter convention, Edgewater Beach Hotel, Chicago, Ill., March 13-15, 1949.

**Third International Lighting Exposition and Conference**—Hotel Stevens, Chicago, Ill., Week of March 28, 1949.

**Engineers' Council of Houston**—Second annual symposium, Rice Hotel, Houston, Texas, April 2.

**National Country Life Exposition**—Commercial Museum, Philadelphia, Pa., Week of April 11.

**Western Metal Congress and Exposition**—Shrine Convention Hall, Los Angeles, April 11-15.

**Midwest Power Conference**—11th annual conference, Sherman Hotel, Chicago, Ill., April 18-20.

**National Electrical Wholesalers Association**—41st Annual Convention, Netherland Plaza Hotel, Cincinnati, Ohio, May 1-6.

**Chamber of Commerce**—37th annual meeting, Washington, D. C., May 2-5.

**National Fire Protection Association**—53rd annual meeting, Fairmont Hotel, San Francisco, Calif., May 16-19.

**National Industrial Service Association**—Annual convention, Hotel Jefferson, St. Louis, Mo., June 9-11.

**Store Modernization Show**—Grand Central Palace, New York, June 19-24.

**New York State Association of Electrical Contractors and Dealers, Inc.**—Saranac Inn, N. Y., June 25-July 1.

**Illuminating Engineering Society**—National Technical Conference, French Lick, Ind., September 19-23.

**National Electronics Conference**—Edgewater Beach Hotel, Chicago, Ill., September 26-27.

**International Association of Electrical Inspectors**—Western Section, Hotel Radisson, Minneapolis, Minn., September 26-28; Northwestern Section, Butte, Mont., October 3-5; Southwestern Section, Hotel San Diego, San Diego, Calif., October 10-12; Southern Section, Hotel Shamrock, Houston, Texas, October 17-19.

**National Electrical Manufacturers Association**—Chalfonte-Haddon Hall, Atlantic City, N. J., November 13-18.

## Manufacturers News —

### A. F. METZ ELECTED PRESIDENT OF OKONITE

Albert F. Metz was elected president and general manager of the Okonite Company, Passaic, New Jersey, by the Board of Directors at a recent meeting. Mr. Metz, who was previously vice president and treasurer of the company, replaces Frank C. Jones, who died January 20.

The Board also elected as a director, Stephen A. Wilson, the Company's general counsel, and Donald R. Stevens as executive vice president



A. F. METZ

YOU CAN BE SURE... IF IT'S

# Westinghouse



MORE *"Muscle"*  
FOR ELECTRICAL APPARATUS  
*... at no extra cost*

Your apparatus can have higher electrical stamina . . . longer operating life . . . if insulated with Westinghouse "Tuffernell" Insulating Varnishes.

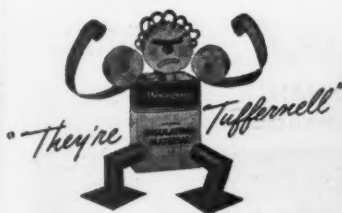
Outstanding among these new varnishes are Tuffernell B-161, B-163, and B-165. All are thermosetting; and each has specific properties of high resistance to heat . . . moisture . . . centrifugal force . . . and to other enemies that break down ordinary varnishes.

It is because of these properties that Baker-Raulang, of Cleveland, chose Tuffernell B-163 for their well-known line of industrial trucks, tractors, and cranes. They like B-163's deep penetration of windings, giving better heat transfer and cooler-running motors. They have found, too, that B-163 is economical and faster to use, and stands up in rugged service.

The complete Tuffernell line includes Insulating Varnishes and Compounds for *your* application. All are described in Bulletin 65-120, available on request.

Investigate Tuffernell today for your needs. Call your nearby Westinghouse office, or write Westinghouse Electric Corporation, Dept. 13, P.O. Box 868, Pittsburgh 30, Pennsylvania.

J-06418



# Westinghouse

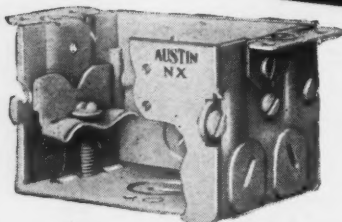
TUFFERNELL INSULATING VARNISHES  
— for every electrical need



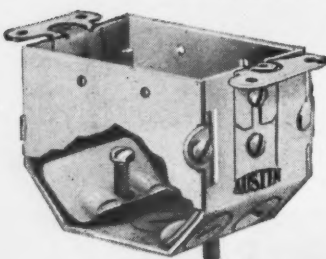
# AUSTIN HAS THE *Standardized Line*

Engineered and made by AUSTIN particularly for use with today's modern building materials and up-to-date wiring methods.

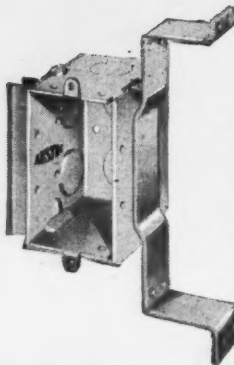
## OF SWITCH AND RECEPTACLE BOXES AND SUPPORTS FOR *Every* WIRING SYSTEM



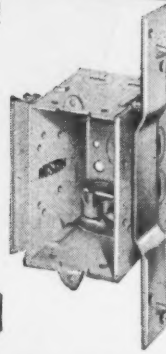
Austin Type NX Box for Non-metallic Sheathed Cable. U. S. Pat. No. 2,348,318.



Austin Type LR Box for Non-metallic Sheathed Cable.



Austin Type CMBR Box shown with BR Universal Mounting Bracket.



Austin Type BXFA-N Box shown with Type A Side Mounting Bracket.

*The M. B. Austin Company*  
NORTHBROOK, ILLINOIS

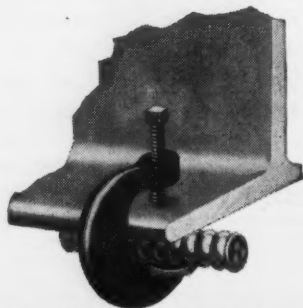
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### "EFFICIENCY" DEVICES FOR CONDUIT and CABLE SUSPENSION

For Solid . . . Non-Slip Support  
of Conduit . . . at any angle to beam  
"EFFICIENCY"  
CONDUIT HANGER Type F

On open steel construction, Type F Conduit Hangers with radiating ridges and five point gripping surface, carry pipe or cable at any angle to beam, on true mechanical principle. Made in capacities from 1/2" to 2 1/2" diameter.

Write today  
for Catalog 38-A.



Supporting Cable parallel to beam



Supporting pipe at right angle to beam

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MANUFACTURERS OF EFFICIENCY  
ELECTRICAL DEVICES FOR CONDUIT,  
WIRE AND CABLE SUSPENSION



**D. R. STEVENS**

and a member of the executive committee. Mr. Stevens was previously a vice president of the company.

Mr. Metz joined the Okonite Company in 1919 as accountant, following a previous career as assistant to the comptroller of Famous Players Lasky Corporation, and as disbursing officer and auditor for the United States Shipping Board during World War I. During his 30 years with the Okonite Company he also served as comptroller and treasurer.

Mr. Stevens joined the organization in 1921 as superintendent and became vice president and works manager in charge of its three plants.

### GENERAL ELECTRIC CHANGES

Ralph M. Darrin, of Schenectady, has been elected a commercial vice president by the Board of Directors of the General Electric Company, and has been assigned to customer relations work in the New England territory, with headquarters in Boston. Until this appointment, Mr. Darrin had been manager of the apparatus department's central station divisions at Schenectady.

J. S. Overstreet has been appointed manager of sales; R. P. Allison named manager of manufacturing; C. O. Hull manager of Bridgeport engineering; and V. A. Sheals manager of Schenectady engineering, Wire & Cable Division of the General Electric Company's construction materials department.

T. R. Hancock has been appointed manager, marketing research division; J. E. Neuberger operating manager of the advertising division; E. N. Kimball, Jr. manager of the procedures division; Murray H. Owen to the staff of the manager of sales, all of the construction materials department, Bridgeport.

The General Electric Company's Lamp Department has established two new sales districts to serve the middle-Atlantic states. They are to be known as the Chesapeake sales district, with headquarters at Baltimore, Md., and the Virginia sales district, with headquarters at Richmond, Va. P. Mason Wood will head the Chesapeake dis-



trict and James P. Roger the Virginia district.

James W. Reynolds, former vice president and director of the Sun Chemical Company of New York, has joined G-E's Chemical Department as sales manager of silicone products. With headquarters at Waterford, N. Y., Mr. Reynolds will have commercial responsibility for G-E silicone gum, oils, emulsions, greases, resins, and water repellents.

The appointment of T. C. Glenn as manager of the engineering division of G-E's newly-created Michigan district has been announced.

Dr. Harry F. Miller has been appointed engineer of the Pittsfield Works Laboratory, G-E transformer and allied products division. He succeeds Mr. A. M. Gifford who has retired after 45 years of service.

### AMERICAN STEEL & WIRE APPOINTMENTS

Appointment of William I. Ong as assistant to the president of American Steel & Wire Company, Cleveland, has been announced. Mr. Ong has directed the company's public relations department since its organization in May 1937, and the Ohio-Michigan district public relations activity of other U.S. Steel subsidiaries as well. Prior to 1937 he was associated with Dow-Jones & Co.

Lewis E. Zender, member of the public relations staff for eleven years, has been appointed the company's public relations director. He succeeds Mr. Ong.

### WESCO ANNOUNCEMENTS

G. I. Hicks has been appointed Southern California district apparatus and supply manager for the Westinghouse Electric Supply Company. He succeeds W. A. Matzinger, who has been appointed Southern California district lamp and lighting manager.

Ray Robinson and George C. Pegg have been named Southern California district specialties manager and personnel supervisor respectively.

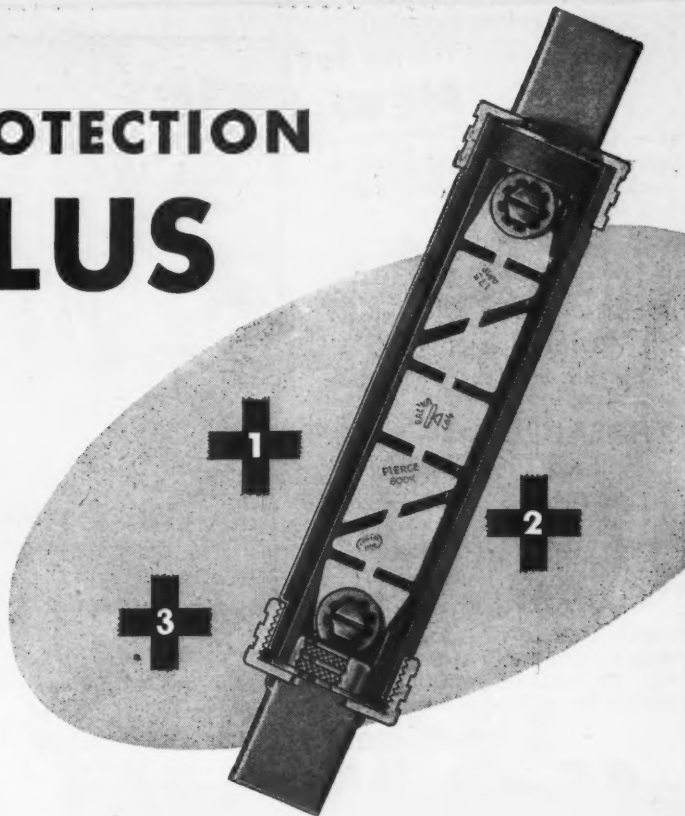
H. H. Falkner has assumed the duties of Southern California district farm sales supervisor with headquarters at Salt Lake City.

The appointment of Adrian Springer as Northern California district stores manager with headquarters at San Francisco has been announced. He succeeds E. G. Alexander, who has been named district purchasing supervisor. Mr. Springer was Oakland branch stores manager, which duties have been assumed by Robert Lyon, formerly district purchasing supervisor.

H. F. Lindstrom has been named manager of the Tulsa branch, succeeding W. A. Bent, who has been granted a leave of absence.

The Pittsburgh offices and ware-

## PROTECTION PLUS



## PIERCE PLUS-VALUES . . . MORE For Your Money

Of course, all good fuses meet Underwriters' requirements, but only Pierce fuses have these *three protection extras*. Pierce fuses are designed to prevent costly power interruption from unnecessary fuse failure. Pierce fuses . . . and only Pierce fuses . . . have these exclusive protection-plus features:

### PROTECTION AGAINST BLOW FROM HARMLESS SURGES

Pierce "Balanced Lag" link sustains harmless jolts and surges in the working overload range which often blow ordinary fuses. Yet it blows instantly on dangerous short or ground. By sustaining all safe loads, blowing only when danger threatens, "Balanced Lag" eliminates costly, unnecessary power interruptions.

### PROTECTION AGAINST CASE FAILURE

The strong tubular bridge construction and simplicity of design in Pierce fuses ensure maximum case life and clip contact, and prevent the misalignment common to ordinary fuses.

### PROTECTION AGAINST AFTERBLOW

Pierce fuses are screen-ventilated and operate from 10 to 50 per cent cooler, preventing unnecessary blow from stored or secondary heat held in ordinary fuses.

# PIERCE

For Forty Years, Specialists in the Design and Manufacture of Fuses  
**RENEWABLE FUSES, INC.**

177 Pacific Avenue \* Buffalo 7, N. Y.

## Write for NEW CATALOG

Now ready—  
the new catalog showing every  
conduit fitting, coupling and accessory  
in the Kondu line.

### Wide Variety

The most complete line of thread-  
less fittings ever presented.

### THREADLESS and THREADED

The Threaded Kondu fittings  
have covers and other accessories  
interchangeable with the Thread-  
less line.

### ALUMINUM ALLOY

used exclusively—2/3 less weight,  
with no sacrifice of strength. And  
they are practically corrosion-proof. Write for new catalog, showing complete  
Kondu line of conduit fittings and accessories.

KONDU CORPORATION, Erie, Penna.

# KONDU

The Most Complete Line of Unparalleled Variety



KONDU  
MFG. CO., LTD.,  
Preston,  
Ontario



house facilities of Wesco, has been  
consolidated in its new two story and  
mezzanine office building and warehouse,  
located at 209 West General Robinson  
Street, Northside.

### WESTINGHOUSE APPOINTMENTS

The appointment of two key execu-  
tives to guide the research and engi-  
neering for the Westinghouse Elec-  
tric Corporation's new Atomic Power  
Division has been made by Charles  
H. Weaver, division manager, Pitts-  
burgh, Pa.

Dr. William E. Shoupp, distin-  
guished nuclear physicist, was named  
director of research and Robert A.  
Bowman, experienced engineer espe-  
cially familiar with heat transfer and  
ship propulsion problems, was ap-  
pointed manager of engineering.

Dr. John W. Coltman has been  
named manager of the Electronics and  
Nuclear Physics Department at the  
Westinghouse Research Laboratories.  
Dr. Coltman, former head of the x-ray  
section of the Laboratories, succeeds  
Dr. William E. Shoupp.

The appointment of C. H. Bartlett  
as manager of power transformer sales  
of the transformer division at Sharon,  
Pa., has been announced.

C. J. Burnside, associated with West-  
inghouse radio and electronic activities  
for 24 years, has resigned and organ-  
ized an independent industrial con-  
sultant service with headquarters in  
Baltimore. He will continue his as-  
sociation with Westinghouse as a con-  
sultant.

### GENERAL SWITCH CORP. APPOINTMENTS

Frank W. Garner, who has been  
sales representative for the Gen-  
eral Switch Corporation, Brooklyn,  
N. Y., in Massachusetts, Rhode Island,  
Maine, New Hampshire and Vermont,  
has now been assigned the state of  
Connecticut in addition to the balance  
of the New England territory.

Appointment of Elmer J. Haines  
as sales representative for the state  
of New York, exclusive of New York  
City, has been announced. Mr. Haines  
will make his headquarters at Kittell  
Road, Syracuse, N. Y.

### FAIRBANKS-MORSE CHANGES

A series of promotions and changes  
in the sales division of Fairbanks,  
Morse & Co., Chicago, were recently  
announced by Robert H. Morse, Jr.,  
vice president.

O. O. Lewis, until a short time ago  
assistant sales manager, has been pro-  
moted to sales manager.

Harry L. Hilleary, who for the past

## Quick, Clean Cutting

For Electricians  
and Linemen

# Clauss

ELECTRICIANS SCISSORS



These sturdy, keen-edged scis-  
sors win praise of electricians and  
linemen for cutting wire, insulation or  
light metal. Hot drop forged, hardened and  
tempered and fully nickel plated, 5" long,  
with heavy blades and shanks. Back of blades  
has deeply serrated scraping and filing edge.  
Stock No. 925.

Order from your Jobber  
or write direct to...

**THE HENKEL-CLAUSS CO.**  
FREMONT, OHIO

New York Offices: 1107 Broadway, WAtkins 9-6797  
Shear Quality Since '77





**O. O. LEWIS**

17 years has been manager of the firm's St. Louis branch, has been transferred to the company's headquarters office in Chicago. He has been named assistant sales manager.

L. A. Weom, manager of the pump division, has been transferred to St. Louis to become branch house manager, succeeding Mr. Hilleary.

Donald T. Johnstone, assistant manager of the pump division, succeeds Mr. Weom as manager of the corporation's pump division with offices in Chicago.

#### **F. A. SMITH MFG. CO. CHANGES NAME**

FASCO Industries, Inc. is the new name for F. A. Smith Manufacturing Co., Inc., manufacturers of fans, motors, ventilators, blowers and automotive electrical equipment. The new name conforms more closely to the trademark "FASCO" used on the company's products.

There is no change in corporate structure, officers, directors, or policies.

#### **ELECTRO MFG. APPOINTMENTS**

Electro Manufacturing Corporation, of Chicago, has announced the election of Leslie K. Schoenbrod as president and general manager. He was formerly vice president and has been with the company since 1939.

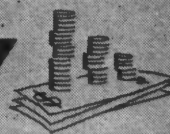
William D. Cahill has been appointed vice president in charge of production. He was formerly secretary-treasurer of the firm.

Charles I. Schneider continues as general sales manager.

#### **SYLVANIA APPOINTMENTS**

H. G. Kronenwetter, formerly advertising production manager for the Radio Division has been appointed manager of advertising production for the lighting fixtures, lamp, radio, electronics and international divisions of

# *Save* TIME AND MONEY



BY USING THE

## *Safety-Engineered*



**M·S·A**

**VELOCITY-POWER**

# *Driver*

- SELF-CONTAINED
- PORTABLE
- EFFICIENT
- NO RECOIL
- FLASHLESS
- EASY TO USE
- WEIGHS ONLY  
4½ POUNDS

This modern self-powered Tool gives you speed, safety and dependability in anchoring conduits, attaching ductwork, hanging pipe or conveyor brackets to steel or concrete! The M.S.A. Velocity-Power DRIVER is the only powder-actuated tool employing an integral stud and piston which remain fastened together until the stud is imbedded—preventing ricochet, flash, recoil or disturbing noise.

• Driver cannot operate unless safety arm is rotated and held in position. Demonstrations? Gladly, on request.



WRITE FOR BULLETIN TA-15.



**M·S·A**

**MINE SAFETY APPLIANCES COMPANY**

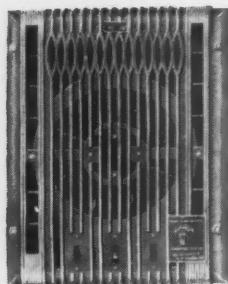
Braddock, Thomas and Meade Streets · Pittsburgh 8, Pa.

At Your Service: 54 BRANCH OFFICES  
IN THE UNITED STATES AND CANADA





SERIES 250 . . . new intermediate duty fan Heetaires . . . 1500 to 3000 watts.



SERIES 210 . . . new heavy duty fan Heetaires . . . 3000 to 6000 watts. Built-in thermostat models . . . 3000 and 4000 watts.

# NOW! 2 NEW SERIES OF HEETAIRES!

**HEETAIRES** — in a complete size range — give you everything!

- A Complete Heat Range—  
Fan Forced Heated Air—

Intermediate Series 250 (1500 to 3000 Watts)

Heavy Duty Series 210 (3000 to 6000 Watts)

- 1500 to 3000 Watts—120 and 240 Volts
- 3000 to 6000 Watts—240 Volts
- With and Without Built-In Thermostats
- Separate Fan Control
- Wall Inserts and Wall Attachables
- Mass Priced and Precision Engineered

NEW! Series 230 KT . . . new Fan-Glo Heetaires with Built-In Thermostats! Write for details.



Tested and listed under reexamination service by Underwriters' Laboratories, Inc.

Write, wire or phone your supplier, or us—for complete story of **HEETAIRE** profits!

**MARKEL ELECTRIC PRODUCTS  
INCORPORATED**

147 SENECA ST.,

**LA SALLE LIGHTING PRODUCTS  
INCORPORATED**

BUFFALO 3, N. Y.

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**FULL HOUSE!**

**EVERYTHING FOR THE COMMERCIAL OR INDUSTRIAL  
ELECTRIC REPAIR SHOP!**

WRITE FOR FREE, 238 PAGE ILLUSTRATED CATALOGUE  
(On Your Letterhead, Please)

**COMPLETE - READING ELECTRIC CO., INC.**  
102 S. JEFFERSON ST., CHICAGO 6, ILL. TELEPHONE: CENTRAL 6-5390

*"Your Best Source of Supply"*

Sylvania Electric Products, Inc. He will continue to make his headquarters at Emporium, Pa.

Dr. B. H. Alexander, formerly professor of metallurgy at the Carnegie Institute of Technology has joined the staff of the Metallurgical Research Laboratories of Sylvania at Bayside, N. Y. He will head the newly formed group engaged in theoretical studies of the basic behavior of tungsten, germanium, and other materials.

Dr. J. R. Dedrick, formerly associate professor of powder metallurgy at the University of Cincinnati, has been appointed section head of the advanced development group at the Bayside Laboratories. Dr. Dedrick will have charge of the group doing work of a research nature but dealing with problems important to commercial products in contrast to other groups at work in the laboratories on theoretical problems of pure science.

## GRAYBAR CHANGES

J. D. Akers has been named manager of the Lansing branch of Graybar Electric Company. He was formerly manager of the Outside Construction and Supply Department at Kansas City.

B. R. Cole has been appointed manager of the Graybar-Fresno branch. He joined the organization in 1932 and since 1946 has been manager, Broadcast Equipment Sales at San Francisco.

## SYNTRON CHANGES

Syntron Company, Homer City, Pa., announces the establishment of several new district sales offices and promotion of sales personnel.

W. C. Leasure of the company's general offices in Homer City has been promoted to district sales manager in charge of the new sales office in Houston, Texas.

Nelson C. DeVilling, formerly of the Pittsburgh sales office has been promoted to district sales manager of the new sales office in Dallas, Texas.

Dick McHale of the Chicago office has been transferred to district sales manager of the Los Angeles office.

James B. Barth has been appointed to replace Mr. DeVilling on the staff of the Pittsburgh sales force and G. R. Stocum is taking over Mr. McHale's duties in the Chicago sales office.

D. E. Nugent has been appointed to take over power tool sales in the Kansas City, Mo. office, which has recently moved to the Wirthman Building, 31 St at Troost Avenue.

George L. Chedsey has been appointed supervisor of mining equipment. He will work out of the company's main office.

John C. Mitchell will take over power tool sales in the Boston office;

and F. J. Kirby, Jr. will handle power tool sales in the Cleveland office.

The Philadelphia branch sales office has moved from its former location on Spring Garden Street, to larger quarters at 1018-20 West Lehigh Avenue, Philadelphia.

The American Coach & Body Company, Cleveland, Ohio, has named Paul V. Dimmick to succeed Deming Bronson as central division sales manager with headquarters at Cleveland, Ohio. Mr. Dimmick will cover Ohio, Western New York, Western Pennsylvania and West Virginia. Mr. Bronson, who has resigned, will return to the West Coast to engage in the lumber business.

Assisting Mr. Dimmick will be Arthur C. Frank, who will cover Michigan, Indiana and Kentucky with headquarters in Cleveland.

Ward Leonard Electric Co., Mount Vernon, N. Y. has opened a Los Angeles branch office and warehouse, located at 420 South San Pedro St. H. S. Fales has been named district manager, and E. R. Slivinsky assistant.

The appointment of C. Harold Phillips as plant manager of the Fort Wayne plant of the Essex Wire Corporation has been announced. He succeeds the late Herman Arber.

The appointment of Lester Geis, architect and designer, to the New York office staff of Garden City Plating & Manufacturing Company of Chicago, has been announced.

The appointment of Robert N. Blatchford as sales promotion manager of BullDog Electric Products Co., Detroit, has been announced.

J. C. van Groos, West Coast representative for the Superior Electric Company of Bristol, Conn., has moved into new quarters at 1436 North Serrano Avenue, Hollywood, Calif. He was formerly located at 1406 South Grand Avenue, Los Angeles.

The Detroit district sales office and warehouse of Cutler-Hammer, Inc., Milwaukee, has moved to new quarters at 15427 Woodrow Wilson Avenue, Detroit, Mich. F. F. Weiss is Detroit district manager.



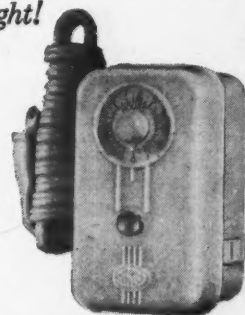
# for Ideal Attic Fan Control

## The New Sangamo Timer

Sangamo Quality Interval Type Timers provide an automatic OFF operation following an elapsed ON interval which is manually preset for each operation. The unusually quiet, low-speed hysteresis-type motor operates only after the manual setting has been made. The operating range includes any period from 15 minutes to 12 hours. While designed primarily for ideal attic fan control, these timers are suitable for many other applications.

Sangamo Type T Timers are extremely attractive in appearance, may be either wall or switch box mounted, and are fully guaranteed and priced right!

The new Sangamo Timer is also available in a plug-in type (Type TJ), rated at 10 amperes or 1/4 hp., for portable appliance installations.



Both types are available now. Bulletin 1070A gives full information—write for your copy.

**SANGAMO**  
ST493  
**ELECTRIC COMPANY**  
SPRINGFIELD, ILLINOIS



See our Exhibit at Space No. 42 — International Lighting Exposition

**"JUST  
A  
SNAP"**

FOR BOTH  
AC AND DC



**QUICK READINGS  
WITHOUT BREAKING  
CIRCUIT**

Instant current readings by merely placing the tongs around the electrical conductor—without breaking circuit or insulation. It's safe, convenient and accurate. Tong Test is the only ammeter of its type that can be used on both AC and DC. Cannot burn out for it has no windings. Interchangeable scale ranges up to 1000 amperes. Five types to accommodate cables up to 3 7/8", bus bars up to 4 1/2" x 1/2". Voltage readings, too, with the Voltor Attachment.

Write for Tong Test Bulletin CM-400



**COLUMBIA ELECTRIC MFG. CO.**

4541 Hamilton Ave., Cleveland 14, Ohio

For unexcelled dependability and permanence

*Specify and Install*

**TIME SWITCHES**

EQUIPPED WITH SYNCHRONOUS,  
SELF-STARTING MOTORS

A. C. OR D. C. OPEN OR CAN TYPE  
WITH TUBE-BASE PLUG-IN FEATURES

Highest quality material and unexcelled craftsmanship combine to make Automatic Time Switches the preference of those who demand long life dependability backed by an unconditional guarantee.

Compact, carefully engineered Automatic Time Switches have new type, easily set trip levers. Trip levers and dial are visible thru window in attractively finished, tamper-proof case.

Stock Models: Single Circuit, Single Pole, 10 Amperes Capacity to Two Circuit, Four Pole, 45 Amperes Per Pole Capacity. Special models engineered to your requirements.

**RELAYS**

Automatic Electric Relays . . . Midget, Interlocking, Circuit Control, Latching, Adjustable . . . are built to exacting high standards to assure unexcelled dependability. Custom built relays designed to your specifications.

Accurately rated Automatic Electric Relays deliver "Diamond Quality" performance.

Write for complete specifications.

LOOK FOR THE DIAMOND SEAL FOR DIAMOND QUALITY

**Automatic Electric MFG. CO.**

50 STATE STREET  
MANKATO, MINNESOTA

The appointment of three men to sales supervisory posts in its electrical insulation and sound recording tape division has been announced by the **Minnesota Mining & Manufacturing Co.**, St. Paul, Minn. They are James J. McDonald, with headquarters in New York; S. P. Van Arsdall, Chicago; and James J. O'Brien, Cincinnati.

The **Philip Carey Mfg. Company**, Cincinnati, Ohio, has named J. J. Smiley, Jr. as commodity manager for the sale of Miami Carey fans.

The **Standard Transformer Company**, Warren, Ohio, has announced the appointment of Robert P. Smith, 123 W. Beaver St., Jacksonville, Fla. as its representative for the state of Florida.

The **Wheeler Insulated Wire Company**, Inc. has moved from Bridgeport to Waterbury, Conn. The company became a division of the Sperry Corporation in 1943.

J. R. Thompson has been named manager of flat belting, conveyor, elevator and transmission belting in the industrial products sales department of the **B. F. Goodrich Company**, and Paul W. Van Orden manager of "V" belts and packing.

**Simplet Electric Company's** New York offices were recently moved to larger headquarters at 11 Park Place, New York.

H. V. Nye has been named consulting engineer for the switchgear section of **Allis-Chalmers** electrical department. T. G. A. Sillers succeeds Mr. Nye as engineer-in-charge of switchgear design.

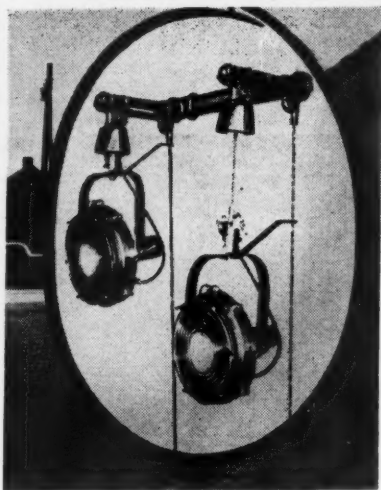
The **Lau Blower Company** of Dayton, Ohio, has announced the appointment of Edward V. Sullivan as advertising and sales promotion manager.

Appointment of Leslie E. Bluhm as Milwaukee field engineer for the **Nelson Stud Welding Division** of Morton-Gregory Corporation has been announced. His office is at 312 East Wisconsin Avenue, Milwaukee.



## EQUIPMENT NEWS

[FROM PAGE 110]



face contacts which complete circuit when fixture is raised. Weatherproof canopy of No. 170 provides for conduit connected wiring entrance integral with sheave housing. Canopy of No. 180 is drilled for  $\frac{3}{4}$  inch conduit entrance and is fitted with removable two-hole threaded-porcelain bushing. Can be supplied for either manual or winch operation. Units are Underwriters' Laboratories rated 15 amp., 600 volt, a-c, 30 amp, 250 volt a-c, and 20 amp. 250 volt d-c. The Thompson Electric Co., 1101-57 Power Avenue, Cleveland 14, Ohio.

### Bushings

New high voltage sidewall bushings have reduced tank height as much as three inches on the entire line of 2400 volt distribution transformers in the 5.0 kv. insulation class, 100 kva. and below. This bushing arrangement combines all of the mechanical advantages of a tank-wall, stud-type bushing plus the electrical and weather protective advantages of a pocket-type bushing. It eliminates wall-type pockets. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

### Circuit Interrupters

Circuit interrupters are now available in cast iron enclosures. The enclosures include weatherproof, dust-tight, dust-resisting and explosion-resisting types. They enable interrupters to be located in dusty, gritty, explosive or other hazardous atmospheres, outdoors or indoors, and in locations exposed to splashing or dripping water. They are identical to correspond-



The NEW McGill 505 All Purpose Service Light is equipped with concentrating lens to focus light where you need it most. Concentrating lens make light from 100 watt bulb  $6\frac{1}{2}$  times as bright at two feet . . . doubles the intensity at eight feet. Simultaneously, the adjustable rotary reflector spreads ample illumination. Equipped with handy wire bracket stand the 505 can be used on the floor and easily positioned through a full horizontal swivel and  $270^\circ$  vertical arc to focus light conveniently at any angle. With stand removed the 505 can be mounted on wall or ceiling. Ruggedly built of heavy zinc plated steel wire, electrically welded. Handle is polished hard wood. The 505 is equipped with LEVOLIER switch and 25' of oil and grease proof Vynl Thermoplastic cord and plug.

### PORTABLE GUARDS FOR EVERY REQUIREMENT

Built of highest quality material and backed by 44 years of "know-how." Cages heavy steel wire plated for long life, exclusive No-Rol design. Handles of rubber or wood with internal construction that takes strain off of socket and cord connection, complete with rubber bushing for extra protection. Sockets and switches all meet or surpass Underwriters requirements.

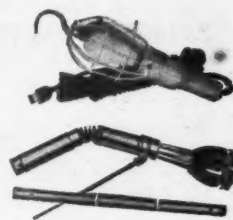


No. 7000-SR—Most popular design all-purpose guard. Rubber handle. No-Rol cage.

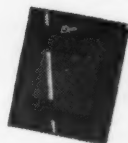
No. 3006 Vapor-proof — Watertight and moisture proof. Light weight. Heat resisting globe.

No. 8025-SR—Service Light—Wood handle. Thermoplastic cord and plug. No-Rol cage.

No. 151-CA Lamp Changer — Head with angle adjustment. New insulated interchangeable 5' section steel poles.



"AVAILABLE FROM YOUR ELECTRICAL WHOLESALER"



For Catalog No. 43 write to McGill Mfg. Co., Inc., 450 N. Campbell St., Valparaiso, Indiana.



**McGILL**  
TRADE MARK

electrical  
specialties

**ONLY McGILL MAKES Levolver SWITCHES**



# Best Buy

**FOR BIG USERS**  
... the  
**BIG 10-ROLL CAN of GOLD SEAL TAPE**

● Off the market during the war, this handy 5 pound can of Gold Seal Tape is back again... the best buy for regular users. Every roll is doubly protected for factory freshness.

Whatever way you buy tape, you'll find Gold Seal always just right in "tack"; clean handling; non-raveling; non-peeling. Try it. Jenkins Bros. (Rubber Div.) 80 White Street, New York 13.

Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet ASTM and Federal Specifications.

**JENKINS Gold Seal Tape**  
FRICTION-RUBBER

MADE BY JENKINS BROS. ... MAKERS OF FAMOUS JENKINS VALVES

**EASY TO WIRE!**  
**EASY TO MAINTAIN!**



**SERVICE STATION  
AIRPORT • SPORTS • MARINE •  
INDUSTRIAL LIGHTING...  
EQUIPMENT BY**

**Revere**  
ELECTRIC MFG. CO. CHICAGO, ILL.



Convertible with 5-light cluster—The unit of many applications—Available in aluminum or porcelain enameled colors.

WRITE FOR  
COMPLETE CATALOG

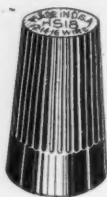
**REVERE ELECTRIC MFG. CO.**

6017 Broadway Chicago 40, Illinois

## BUY . . . . . *Hi-Scale* **BAKELITE SOLDERLESS**

### Wire Connectors

with Complete Confidence



Five sizes for wire combinations from two No. 18 to three No. 10.

Immediate Delivery

Economically Priced

Compare Quality . . .

Compare Prices

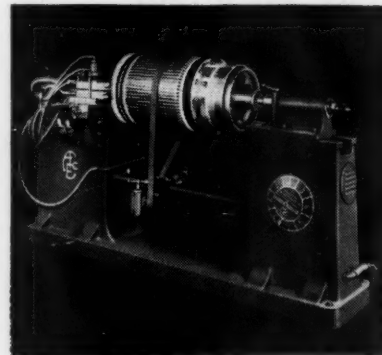


SEE YOUR JOBBER OR  
WRITE FOR PRICE LIST, CATALOG  
SHEET AND COMPLETE DETAILS.

*Hi-Scale Products Corp.*

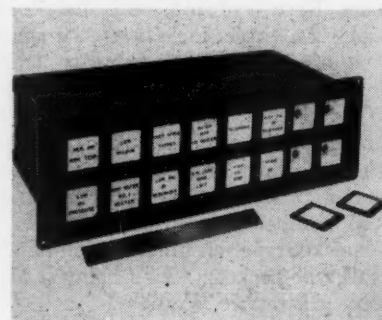
217 Centre St., New York 13, N. Y.

ing circuit breakers, but do not have thermal and magnetic trip features. They are designed for use in locations where space is limited and a local disconnect means is necessary. Square D Company, 6060 Rivard Street, Detroit 11, Mich.



### Brazing Machine

A new stationary brazing machine to facilitate brazing and silver soldering of electric generator and armature coil ends in repair shops has been announced. Known as CBG-24, it can accommodate armatures from 18 to 42 inches in diameter. Unit can also be used as a source of power supply for portable brazing equipment. Machine has a built-in heavy duty 24 kva. transformer with auto-regulating coil and eight point heat control selector, with a wide range of brazing heats. Dimensions are 49 in. high by 24 in. wide by 99 in. long, weight 2400 lbs. American Electric Fusion Corp., 2612 West Diversey Drive, Chicago 47, Ill.



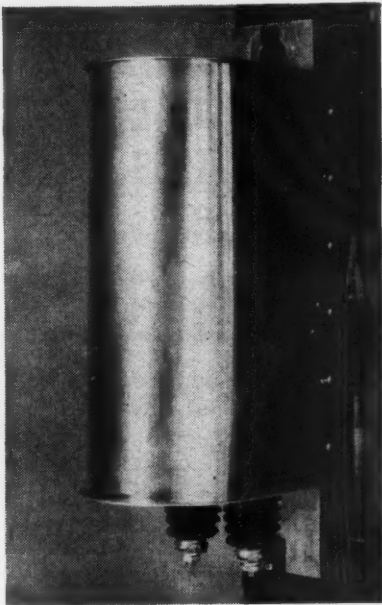
### Annunciator

Specifically designed for heavy-duty operation in industrial plants and public utilities, this new type "ANG" annunciator may be incorporated in new or existing control panels, actuator boards, racks, or power operators' desks. It may be mounted horizontally or vertically. Unit is designed to operate on standard voltages: 24, 48, and 125 volts a-c or d-c. In operation, the closing of a normally open supervisory or "trouble" contact, closes the

control relay of the appropriate annunciator designation. Closing of this relay causes illumination of the lamp behind the designation and sounding of a remote audible alarm which continues to sound until the signal is acknowledged by momentarily pressing a common silencing switch mounted separately from the annunciator. Circulating is arranged so that a common test switch may be used to test all lamps simultaneously. The Autocall Company, Shelby, Ohio

### Starters

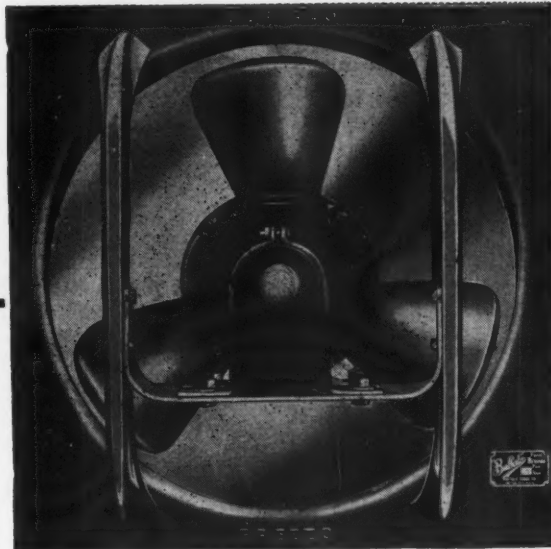
Starters have been developed for three new fluorescent lamps. They are the new 25 watt 33 inch, 85 watt 60 inch and 18 watt Circlarc fluorescent lamps. The FS25 starter is for use with the 25 watt 33 inch and 18 watt Circlarc lamps. The FS85, though designed primarily for use with the 85 watt 60 inch fluorescent lamp, may be used with the 100 watt 60 inch lamp. Both starters have been approved by the Underwriters' Laboratories. Sheldon Electric Company, Inc., Irvington, N. J.



### Capacitor

A new 3-kvar. secondary capacitor, designed for use on 240 volt house feeder circuits has been announced. Advantages include released distribution transformer capacity, reduction in distribution transformer and secondary losses, and reduction in voltage drop between first and last customer on the feeder when capacitors are located only on the secondaries furthest out on the feeder. Rated at 240 volts, single phase, 60 cycles, the new capacitor is

## A "Breeze" to Install —RUGGEDLY, SENSIBLY DESIGNED



*"Buffalo"*

### BREEZO FAN

PUT it in an outside wall where you need to draw off fumes or stale air—hundreds of commercial and industrial firms need this "spot" ventilation! The sturdy die-stamped square panel of the "Buffalo" BREEZO Fan simplifies your installation job. Die-stamped blades are shaped to move the most air on the least power. Rigid panel arms and resilient-mounted motor mean quiet, vibrationless performance. Nothing flimsy about this disk fan—and it's one of our best sellers. Six sizes, 8" to 24". Write for Bulletin 3222-F, at right, and get the facts on these popular, trouble-free "Buffalo" fans.



### FACTS TO MAKE YOUR JOB EASIER!

FAN ENGINEERING, 5th Edition, pocket size, has 808 pages of authoritative answers on air problems. Easy to read. Section on disk fans and every other type of fan. It will help you get better results in your jobs. Send check or money order. Only \$6.00 postpaid.



## BUFFALO FORCE COMPANY

520 BROADWAY

First For  
Fans

BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch Offices in All Principal Cities

PANEL BREEZO FANS BELTED VENT SETS BELT-AIR FANS  
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a complete redesign of existing models. It features a hermetically sealed aluminum alloy case which has two stud type porcelain bushings. Size is 7 in. by 10 in. by 20 in. and is designed for "on-the-pole" mounting with a key-hole slot in bracket at top and a slot at bottom. General Electric Company, Schenectady, N. Y.

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This B-50 electric diaphragm gas valve has been designed for control of natural, manufactured, mixed and liquefied petroleum gases to space and unit heaters, central, floor and wall furnaces and boilers. Consumption is 5 watts. For low or line voltage applications. Standard model and manual opening model with or without electric trip. All body parts die formed aluminum of high density and tensile strength. General Controls Co., 801 Allen Ave., Glendale 1, Calif.

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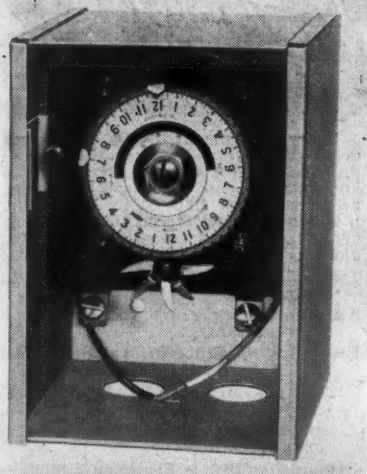
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### Time Switch

The new No. 948 Torkmaster is an all-purpose time switch designed to control window lights, signs, oil burners, coal stokers, hallway lights, poultry house lights, intermittent pumping mechanisms and all types of indoor and outdoor safety lights. Torkmaster can be adjusted in 15 minute steps without special tools. Indoor case is 3½ in. by 4 in. by 5½ in., made of aluminum with special attachment for padlocking. This synchronous, self-starting unit handles up to 30 amps. on a single pole, and operates on 110-125 volt, 60 cycle a-c. Tork Clock Company, 1 Grove St., Mount Vernon, N. Y.

### Insulating Varnish

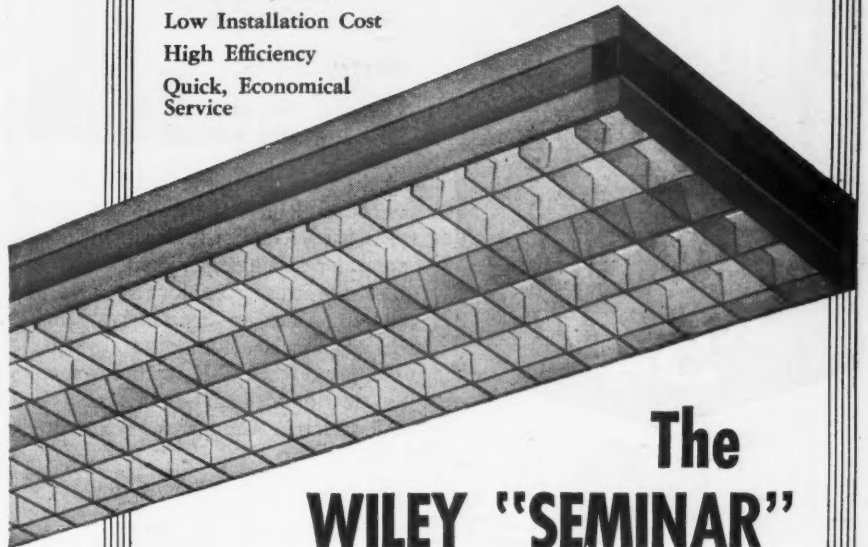
A newly developed internal-curing insulating varnish, known as Harvel 1012C, has been developed particularly for the impregnation of wound structures requiring the maximum in mechanical bonding strength. Also it can be used as an all-purpose varnish. It is a fast curing resin and the cured film is oil-proof, has chemical moisture resistance, and resistance to decomposition under high-temperature operating conditions. Varnish will produce a film thickness of approximately .0025 inch. Irvington Varnish & Insulator Company, Irvington 11, N. J.

### Demand Registers

A new line of demand registers for use by electric utilities in industrial plants and commercial establishments having comparatively small loads has been announced. Available in two models: the indicating type, M-30; and the cumulative type, M-31. The latter type has in addition to an indicating dial, a set of four dials for accumulat-

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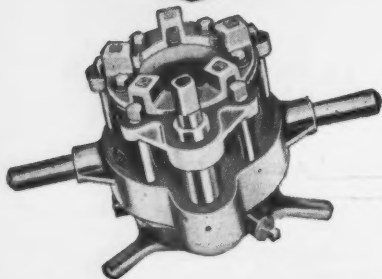
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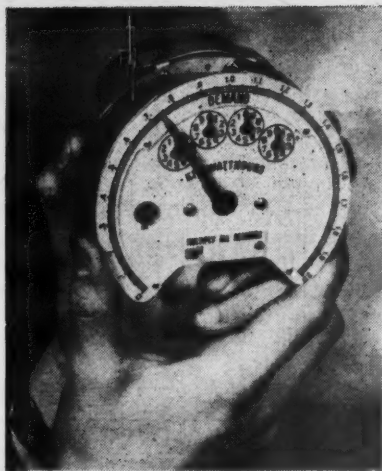
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ing the demand in kilowatt hours from one reading period to another. Both types use a Geneva mechanism for the interval resetting operation. This enables the timing motor to reset the pointer pusher by direct drive gearing without shock. Both registers can be used to convert G-E watt-hour meters into watt-hour demand meters. General Electric Company, Schenectady 5, N. Y.

### Silver Alloy

A new high silver alloy and pocket container have been developed for shop and home use. It is called the Eutec-Silver-Weld pocket economizer for the low heat joining of all metals, except aluminum. It contains a coil of high silver alloy which feeds through a small hole in the top of unit. A separate compartment in the bottom contains a jar of Eutector flux. It is for use in shops for repairing household utensils, electrical connections, pipe and tube fittings, etc. Eutectic Welding Alloys Corporation, 40 Worth Street, New York 13, N. Y.

### Heating Torch

The Crown torch is for all heating operations from silver-soldering to light brazing. It will operate eight hours at a temperature of 2500 degrees. Manufactured to follow the codes of the American Petroleum Institute and the American Society of Mechanical Engineers, it carries the ICC seal of approval. It features an all-in-one tip that eliminates the need for extra tips and tip changes, also a fingertip control of flame size and temperature. A self contained unit, it is made of seamless steel tubing with a chrome finish. Sulley Engineering, Ltd., 9304 Santa Monica Blvd., Beverly Hills, Calif.

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## Pushbutton

This new bar type entrance pushbutton rings the bell from any angle. The escutcheon is of solid forged brass and bar is ivory plastic. Contact mechanism is of the self-cleaning design with phosphor bronze springs. Screw-type terminals protrude from the rear center requiring a  $\frac{5}{8}$  in. diameter hole for mounting. Pushbutton is insulated and intended for use with low voltage only. The overall size is  $3\frac{3}{8}$  in. by  $1\frac{1}{2}$  in. Auth Electric Company, Inc., 34-20 45th Street, Long Island City, N. Y.



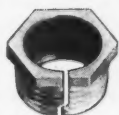
## Tool

A new tool has been developed that enables electricians to fasten fixtures to metal or concrete without using star drills or anchor plugs. It drives plain or threaded studs into concrete floors and walls, steel I-beams and columns by the discharge of a cartridge. Tool can be operated with one hand. The stud, with the cartridge fastened to it, is inserted in the barrel. The user rotates a spring-loaded safety arm to move the firing pin into position. Then, with a sharp push of the barrel against the material to be penetrated, the cartridge discharges and the stud is embedded. By interchanging barrels, tool may be adapted for use of either  $\frac{3}{8}$  in. or  $\frac{1}{4}$  in. diameter studs. Mine Safety Appliances Co., Pittsburgh, Pa.

## New Equipment Briefs

A new, light duty "Hand Type" cleaner for use in stores, offices, repair and service shops has been announced by Ideal Industries, Inc., Sycamore, Ill. . . . The O. Z. Electrical Manufacturing Company of Brooklyn, N. Y. is now offering a new all Bakelite insulating bushing of increased

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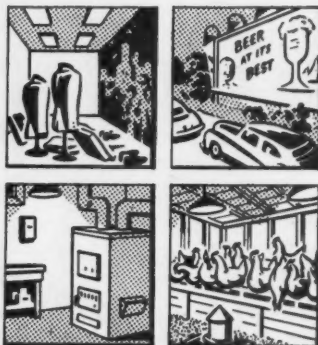
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strength and durability. . . . An explosion-proof floor machine for automatic scrubbing, cleaning and polishing of hazardous areas has been put in production by Multi-Clean Products, Inc., St. Paul, Minn.

A new portable electronic device for thawing frozen water pipes has been developed by the Trindle Products Company, Chicago, Ill. . . . A new 125-ton hydraulic press has been announced by Dake Engine Company, Grand Haven, Mich. . . . Photoswitch Incorporated, Cambridge, Mass. has introduced a photoelectric control for general industrial and machinery application. . . . A new electronic gas filter is now available that will enable steel mills to clean the coke oven gas that accrues as a by-product in the manufacture of coke from Trion, Inc., McKees Rocks, Pa.

The Oster Mfg. Co., Cleveland, Ohio has announced a new pipe threading tool, known as "The Leader—No. 54", a geared receding die stock. . . . A new 450 watt "Thermo-Grip" soldering tool, is available from Ideal Industries, Inc., Sycamore, Ill. . . . The DeVilbiss Company, Toledo, Ohio has a new portable air compressor designed especially for the home workman; small service shop; farmer.

The Kato Engineering Company, Mankato, Minn. has developed a motor and generator assembly which permits obtaining five or six different frequencies of alternating current simultaneously. . . . A new portable electric hammer, Model HDH, has been announced by the Wodack Electric Tool Corp., Chicago, Ill. . . . The Atlas Industrial Corp., Brooklyn, N. Y. announces the introduction of a new hand operated winch.

A new 1/4 inch electric drill with an improved palm-grip handle with trigger switch has been announced by Portable Electric Tools, Inc., Chicago, Ill. . . . The Stalwart Rubber Company, Bedford, Ohio has announced the availability of gaskets, diaphragms, grommets, washers, seals, packings, tubing and other extruded and molded products made from the new X-7 silicone rubber.



New president of the Minneapolis Electrical Contractors Association, Louis LeMay (right), Electric Maintenance Corp., receives congratulations from retiring president Dewey M. Wallin.



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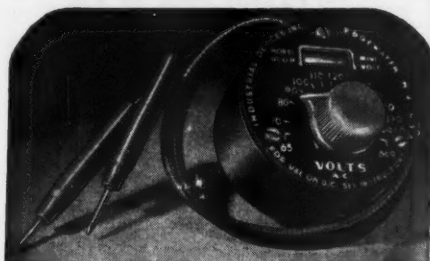


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# OFFICIAL INTERPRETATIONS

[FROM PAGE 136]

**Question 3:** Is it necessary, when applying Tables 1, 2, and 4 of the 1947 edition of the National Electrical Code to limit the allowable current-carrying capacity of motor circuit conductors, when associated conductors for Class I remote control and signal circuits (Article 725) are contained in the same conduit or tubing and on the basis of the total number of conductors in the raceway?

**Finding:** No, only the power load conductors need be counted.

**Section 3736.** Interpretation No. 284. Issued January 22, 1947. Locknuts With Bushings of Insulation Material.

**Question:** Was it the intent of the Electrical Committee that the last sentence of paragraph b of section 3736 of the 1947 edition of the National Electrical Code applies to any bushing constructed wholly of insulating material employed, as provided in section 3468?

**Finding:** Yes.

**Section 2124-b.** Interpretation No. 285. Issue February 5, 1947. Three-pole Laundry Outlets in Apartment Buildings With Central Laundry.

**Question 1:** In a multi-family dwelling of the apartment house type where washing machines are installed by the owner in a laundry room in the basement for the use of the tenants, does the 1947 edition of the National Electrical Code require the installation of a 3-pole receptacle on a No. 12 wire circuit in each apartment to comply with the provisions of paragraphs 2124-b and 2115-b?

**Finding:** No.

**Question 2:** In a housing project comprising several apartment buildings for over 1,200 families, where a central laundry is provided, what would be the intent of the 1947 edition of the National Electrical Code relative to the requirement for the installation of 3-pole receptacles for the connection of laundry appliances?

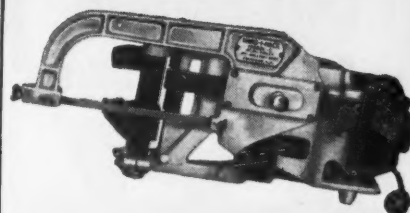
**Finding:** The intent of the Code is to require 3-pole receptacles in the laundry locations, which in this case is the central laundry provided for the individual tenants in the several apartment buildings comprising the housing project.

**Table 11, 1947 Code.** Interpretation No. 286. Issued February 14, 1947. "Rewiring" in Exposed Raceways.

**Question:** Is it the intent of Table 11—1947 edition of the National Electrical Code to permit rewiring in existing exposed raceways, where it might be necessary to enlarge holes through floors, walls, etc., and thereby disfigure the finish of buildings to install larger size raceways?

**Finding:** No, it is the intent that this provision apply to concealed raceways.

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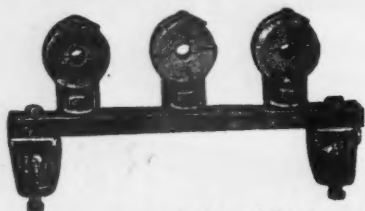
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Section 7113. Interpretation No. 280. Issued November 15, 1946. Open Conductors—Supports and Separation.

**Question:** Is it the intent of the National Electrical Code that the phrase "other material approved for the purpose" in section 7113 be interpreted by authorities having jurisdiction as including cleats of hard wood, such as may be found in equipment served by the wiring?

**Finding:** Yes, the authority should exercise its judgment in the matter.

Sections 2351 and 2371. Interpretation No. 288. Issued May 16, 1947. Disconnecting Means in Multiple Occupancy.

**Question 1:** In view of paragraph 2351-b of the 1947 edition of the National Electrical Code recognizing the disconnecting means (in multiple occupancy buildings) of not more than 6 switches or circuit breakers supplied by a service, and paragraph 2301-b recognizing two or more sets of service entrance conductors from one service drop, is the limitation of 6 switches or circuit breakers per set of service conductors or per building?

**Finding:** The conductors entering a multiple occupancy not having a common readily accessible space, as permitted by paragraph b of section 2301, are a "set of service conductors" as referred to in the first paragraph of section 2351, and the limitation of 6 switches or circuit breakers applies to a set of service conductors and not to the building. If the multi-occupancy building has a common readily accessible space the limitation applies to the building.

**Question 2:** Are the switches referred to in sections 2351-a and 2351-b a specific type such as the conventional enclosed switch containing an externally operated switch and fuses (suitable for use as service equipment) or can they be merely unfused switches?

**Finding:** Note the last sentence of paragraph a of section 2351: "The disconnecting means shall be of a type approved for service equipment and for prevailing conditions."

**Question 3:** Is it the intent of section 2371 of the 1947 edition of the National Electrical Code, in a multiple occupancy supplied by a single service drop, and a single set of service entrance conductors, to permit up to 6 switches, each switch having 6 sets of fuses and each switch having its own main disconnect in the same enclosure but no main fuses, and no main switch and/or fuse ahead of the 6 switches?

**Finding:** This question is answered by Interpretation No. 141, which reads as follows:

(Limit of service Disconnecting Means, Section 2351 and 2371)

**Question:** Under sections 2351 and 2371 of the 1937 edition of the National Electrical Code, is it permissible to install six sets of circuit breakers, each set consisting of six circuit breakers

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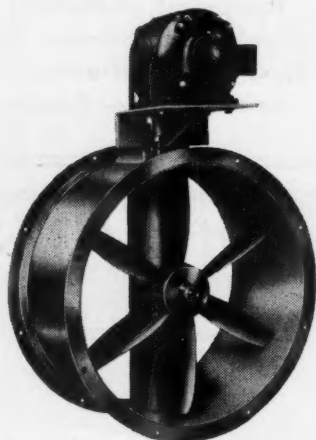
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in a separate enclosure; or six sets of fused switches, each set consisting of six fused switches in a separate enclosure, without a main line disconnecting means.

**Finding:** No.

**Question 4:** In complying with the requirements of section 2371 of the 1947 edition of the National Electrical Code, how many of the switches described in Question 1 could be installed on a single set of service entrance conductors without installing a main switch and/or fuses?

**Finding:** Six switches.

**Question 5:** With reference to section 2371-a-4 (3), what constitutes a separate sub-division of the service?

**Finding:** A service switch and its accompanying fuses or a service circuit breaker constitutes a separate sub-division of the service.

**Article 390.** Interpretation No. 289. Issued March 20, 1947. Wiring of Prefabricated Buildings.

**Question:** Was it the intent of Article 390 that the term "existing outlet" as used in Articles 342 and 344, be restricted in the case of prefabricated construction (Article 390) to installations made after completion and occupation of the building in question?

**Finding:** Yes.

**Section 4325.** Interpretation No. 290. Issued May 26, 1947. Shunting During Starting Period.

**Question 1:** Regarding section 4325 of the 1947 edition of the National Electrical Code, is it the intent that the term "automatically started" refers to starting of a motor by means of a magnetic starter with pushbutton control?

**Finding:** No.

**Question 2:** Provided starting is accomplished manually or by a magnetic starter with pushbutton control, is the term "automatically started" in the last sentence of section 4325 intended to prohibit the use of a time-delay relay which will automatically maintain the shunting of the overcurrent protective device only for the time sufficient to allow the motor to start?

**Finding:** No.

**Section 5019.** Interpretation No. 291. Issued May 2, 1947. Fixed Lights in Class I, Division 2, Locations.

**Question:** Does item 2 of section 5019 of the 1947 edition of the National Electrical Code require the use of vapor-tight types of lighting fixtures?

**Finding:** No, unless the fixture is in a damp or wet location; see section 4111.

**Section 3624.** Interpretation No. 292. Issued July 17, 1947. Number of Conductors in Raceway.

**Question:** Is it intended that the reduction in allowable current-carrying capacity of each conductor, that is given in Note 4 following tables 1 and 2 of the 1947 edition of the National



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Electrical Code, be applied to the conductors in wireways and in auxiliary gutters that are installed otherwise in full conformity with sections 3624 and 3745, respectively?

Section 2583-b. Interpretation No. 293. Issued June 4, 1947. Pipe Electrodes.

**Question:** When conduit is used as a grounding electrode, is the requirement of sub-paragraph b of section 2583 of the 1947 edition of the National Electrical Code met if the conduit is galvanized on the outside only?

**Finding:** Yes.

Article 336. Interpretation No. 294. Issued June 16, 1947. Non-metallic Sheathed Cable.

**Question:** May the non-metallic sheathed cable wiring method be employed for quonset huts and other sheet metal buildings?

**Finding:** Yes.

Section 2115-B. Interpretation No. 295. Issued June 16, 1947. Receptacle Circuits (Dwelling Occupancies).

**Statement:** A 3-wire circuit is run to a laundry outlet as required by subparagraph b of section 2115 of the 1947 edition of the National Electrical Code, then a 2-wire tap is carried on from that point to supply ceiling light outlets and/or receptacles in the laundry or other part of the basement.

**Question:** Does the installation described violate the limitation "such circuit shall have no other outlets"?

**Finding:** Other receptacles supplied by this circuit shall be only "for the small appliance load in kitchen, pantry, dining room, and breakfast room." In other words, the circuit should not supply a lighting load.

Table 31. Interpretation No. 296. Issued July 17, 1947. Flexible Cord.

**Question:** May the cord from a thermostat, series-connected at the convenience outlet plug in the supply cord to a portable heater be one of the cords listed for portable heaters in Table 31 of the 1947 edition of the National Electrical Code?

**Finding:** Yes.

Section 4150. Interpretation No. 297. Issued July 17, 1947. Fixture Raceways.

**Question 1:** May an installation of fluorescent fixtures approved for end-to-end assembly be supplied by a multiwire branch circuit?

**Finding:** Yes.

**Question 2:** May the ungrounded conductors of a multiwire branch circuit (supplying fluorescent fixtures as in question 1) have individual overcurrent protection and control?

**Finding:** Yes.

Section 5015. Interpretation No. 298. Issued August 29, 1947. Sealing.

**Question:** With reference to section

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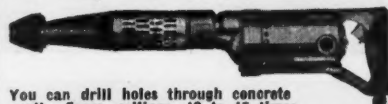
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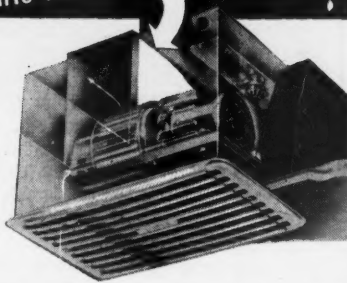


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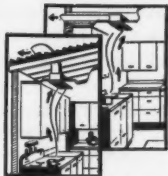
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5015 of the 1947 edition of the National Electrical Code, are seals required in runs of rigid conduit which pass through a hazardous area but which originate and terminate in a non-hazardous area?

**Finding:** Seals are required at both ends of a run of conduit if the run within the hazardous area contains a box, coupling, fitting, or other enclosure.

**Section 3649.** Interpretation No. 299. Issued August 29, 1947. Reduction in Size of Busway.

**Statement:** A feeder of a busway installation is rated 400 amperes and through a "tee" tap or junction point supplies a branch busway at its center point. The branch is rated 250 amperes throughout its length.

**Question:** Does the 50-foot limit to length of branch, stated in section 3649 of the 1947 edition of the National Electrical Code, apply to the right and left sections of the branch separately?

**Finding:** Yes, the situation appears identical with that which would exist if the two branches were connected at different points of the length of the feeder bus.

**Section 3364.** Interpretation No. 300. Issued November 7, 1947. Protection for Non-metallic Sheathed Cable.

**Question:** Who is to determine what protection if any, from mechanical injury is needed when applying paragraph b of section 3364 of the 1947 edition of the National Electrical Code?

**Finding:** The authority enforcing the code.

**Interpretation No. 301.** Issued February 14, 1948.

**Statement:** A service for a multi-family building is topped at a junction box within the premises supplying two or more individual premises.

**Question:** Does the phrase, "at each individual service" of the first sentence of section 2523 of the 1947 edition of the National Electrical Code forbid a single grounding conductor from the junction box for this service?

**Finding:** No.

**Section 5143.** Interpretation No. 304. Issued July 16, 1948. Wiring and Equipment Near Fuel Storage Tank Vent Pipe.

**Question:** How does section 5143 apply in the case of a vent-pipe from a fuel storage tank?

**Finding:** When in an outside location, the wiring and equipment on a pole standard should be as required for a Class I, Division II hazardous location (Article 500) if within 20 feet horizontally from the vent and if also below the five foot level above ground, unless the authority enforcing the Code specifies that the wiring and equipment must conform to the requirements for a Class I, Division I, hazardous location.

**Section 5015.** Interpretation No. 305.

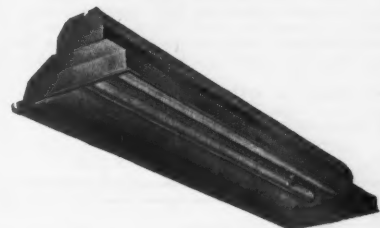


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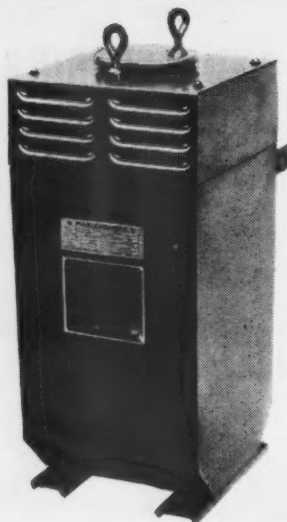
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Issued July 16, 1948. Seal Fittings  
Where Required.

**Question:** In the case of a run of  
conduit two inches or larger in size,  
connecting two terminal or junction  
boxes, when does subparagraph 2 of  
paragraph (a) of section 5015 of the  
1947 edition of the Code call for more  
than one seal?

**Finding:** A single seal is called for  
when its position would be not more  
than 18 inches from either enclosure.  
However, if the conduit run is of more  
than 36 inches in length two seals are  
called for each not more than 18 inches  
from the nearest enclosure.

**Section 3717.** Interpretation No. 306.  
Issued July 22, 1948. Accessibility of  
Junction Boxes.

**Question:** With reference to section  
3717, must a junction box when lo-  
cated in an attic be accessible from  
within the premises if an exterior open-  
ing to the attic "not guarded by eleva-  
tion" is available?

**Finding:** No.

**Section 5015.** Interpretation No. 307.  
Issued July 16, 1948. Type of Fittings  
Not Considered as Enclosures.

**Question:** Are fittings similar to  
Types LBH, EKC, and ESC (C-H  
Company) which are inserted in a con-  
duit system solely to simplify pulling-in  
of conductors and which contain no  
splices to be considered enclosures in  
view of subparagraph 2, paragraph a  
of section 5015?

**Finding:** No.

**Section 5016-a.** Interpretation No.  
308. Issued August 19, 1948.

**Question:** Was it the intent of the  
Electrical Committee that section  
5016-a of the revised Code (1947 edi-  
tion) bring about changes in the design  
of cases for oil immersed switches  
(motor controllers) that had been "ap-  
proved" or listed by Underwriters'  
Laboratories, Inc. (guide 184N13) and  
accepted in the field as satisfying the  
requirements of section 5017 of the  
1937 and 1940 editions of the National  
Electrical Code?

**Finding:** No.

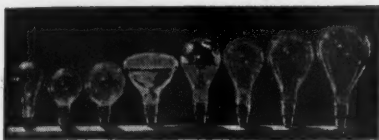
Interpretation No. 310. Issued Sep-  
tember 10, 1948.

**Question:** Concerning equipment for  
circuits over 600 v, Articles 230 and  
710; is it the intent that "air" circuit  
breakers be not used when the text of  
the National Electrical Code mentions  
oil circuit breakers?

**Finding:** No!—generally speaking,  
specific mention of oil circuit breakers  
infers need for safeguarding because  
of the oil. Air circuit breakers (and  
switches) for use as required discon-  
necting means of for over-current pro-  
tection are acceptable in lieu of oil  
circuit breakers (and oil switches) if  
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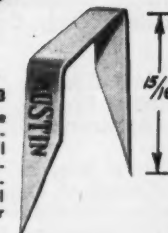


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*"Give us the tools . . ."*

# Now is the time to *FIGHT SOCIALISM* in Washington

**Do we want to follow Britain down the economic skids?**

**We Americans face that question today. For we are being advised by Administration economists in Washington to take the course which destroyed Britain industrially. It is the temporarily easy course of cutting down expenditures for tools in order to have more things to consume right away.**

The President's Council of Economic Advisers tells us we are spending too large a part of our national income on new tools and equipment. A larger share, they say, should go for goods and services used directly by consumers.

Before we take that advice, let us look at Britain. When the British once allowed their industrial plants and equipment to run down — they started down a dreary road to industrial stagnation and decay.

British industry once ruled the world. Low production costs enabled it to undersell all competitors. Efficiency gave British workers the highest living standards anywhere.

Now all that Britain has between it and economic disaster is pluck and American aid through the Marshall Plan.

The British people are living poorly — still on rations and in austerity. With practically everyone working, and working longer hours than we do in the United States, they cannot produce enough to pay for the raw materials and food they must import.

*How did Britain get in this fix?*

The story is complicated. British sacrifices in two wars play a tragic part in it. But another fact also stands out:

*Britain began to go downhill even before World War I — when British industries allowed their plants and equipment to grow obsolete.*

Once that process started, it grew steadily worse. By 1929 the share of Britain's national income being plowed back into capital investment had shrunk to less than two-thirds of what it had been twenty years earlier. We were putting twice as big a share of our national income into capital goods at this same time.

**Skimping on capital equipment — on new plants and new tools — put the skids under industrial Britain.**

World War II only speeded up a process already well under way.

*continued on next page*

British industry today shows the results of its failure to keep up to date. Here are three examples found by Dr. Laci Rostas, Britain's leading authority on measuring workers' productivity:

An American produces *four times* as much pig iron as his British counterpart.

He produces *more than four times* as many tires.

In all industry, on the average, an American produces almost three times as much.

The real reason is the American's better tools. The British are struggling with equipment that is, on the average, forty years old.

Britain once had a big head start in industrial equipment. But she let it slip away. And as it went, Britain's industrial and political leadership slipped with it.

How could British leaders have slept while all this happened?

This, too, is a complicated story. But parts of it stand out clearly:

1. *British business men put in more time perfecting cartels to avoid competition than they did in improving their plants and equipment to meet it.*

2. *British labor leaders concentrated on sharing the work and sharing the wealth—rather than doing the job necessary to have enough wealth to make the sharing worthwhile.*

3. *British governments taxed away the means to buy new equipment. By steadily increasing personal taxes, they undercut the ability of individuals to invest in new equipment. Finally, they took away the incentive to get new equipment by progressively taxing away any returns on it.*

4. *Farseeing socialists smiled all the while, knowing that as private industry more and more lacked the tools to do a progressive job, they would have their chance to run the country.*

Now, with Britain's fate in their hands, the socialists are trying desperately to stem the nation's economic decline by rebuilding its industrial plants and equipment.

They are making a little headway, but not enough. There are several reasons. One is that Britain must export most of the new equipment she can make. *Another major reason—increasingly important for her future—is that money needed to renovate Britain's run-down industry is taxed away to support welfare programs.* The (London) *Economist* grimly puts it this way:

"The importance of the function of saving has only been discovered now that the means of saving have largely been destroyed."

Our own Federal and State governments, too, have dangerously whittled away incentives. They have more than tripled tax rates on personal and corporation incomes in the last twenty years. Now, the President proposes to do more whittling.

**If the United States is not to go Britain's way, we must preserve our incentives to save and to invest in industry.**

**If the United States is to progress, we must continue to build up our industries.**

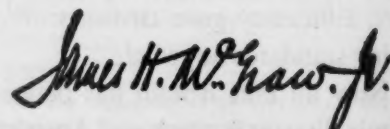
The President's Economic Advisers say we can slow down. But the McGraw-Hill survey of "Business' Needs for New Plants and Equipment," reported in the previous editorial in this series, produced facts to the contrary. It showed that industry now plans—if it can get the money—to spend \$55 billion in the next five years for new plants and new tools. Moreover, it showed industry's needs for new facilities are large.

By cutting down the incentives to save, by giving soothing advice that we do not need to save so much, Washington is pushing us toward Britain's way—the route via industrial stagnation to socialization.

Before we skid too far, we should pull up short and ask ourselves: Do we want to go Britain's socialistic way?

There still is time to say, "No."

A complete report on our national survey, "Business' Needs for New Plants and Equipment," may be obtained by writing McGraw-Hill Publishing Co., 330 West 42nd St., New York 18, N. Y. This is the fifth editorial of a special series on industry's needs for new plants and equipment.



President, McGraw-Hill Publishing Company, Inc.